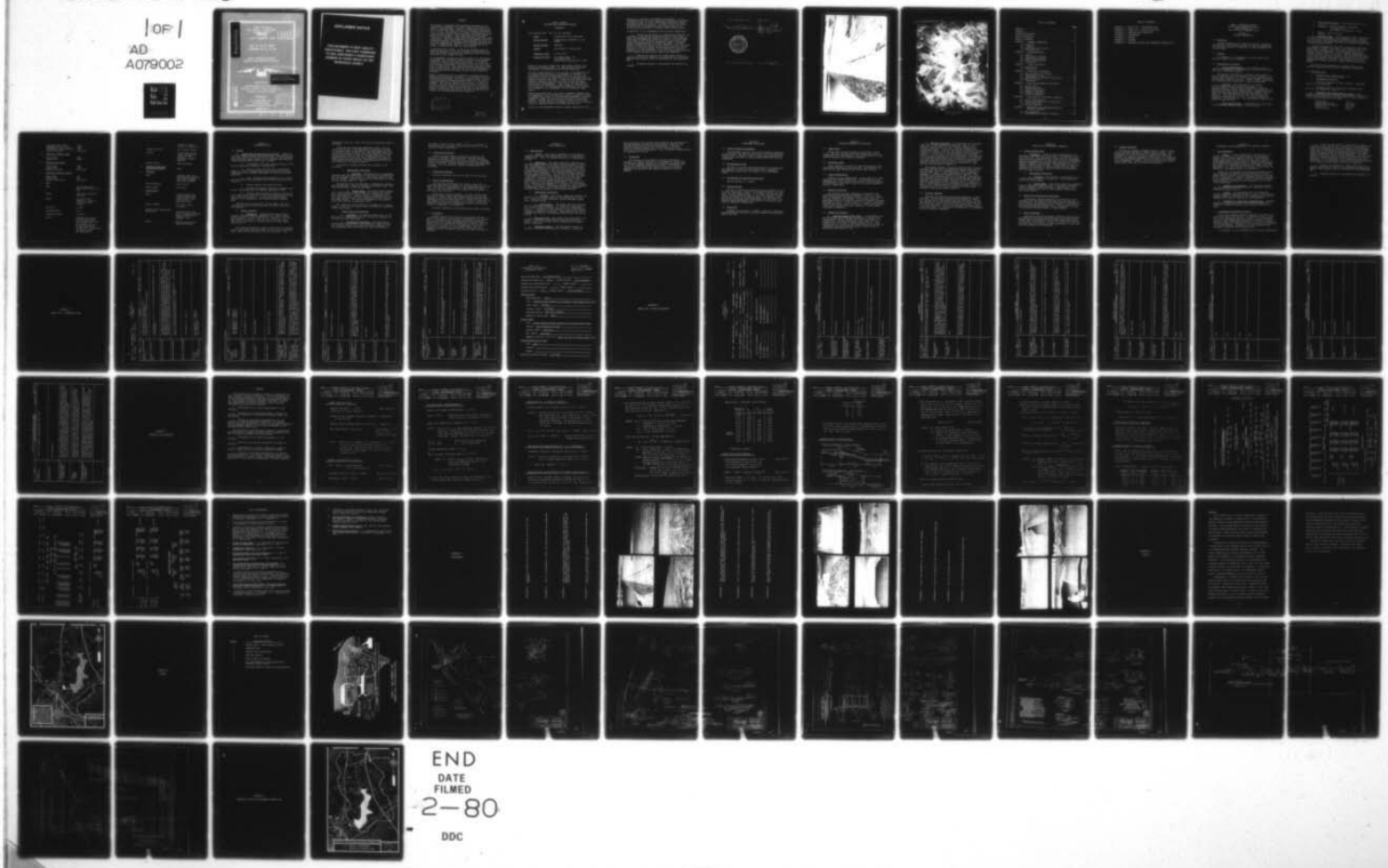
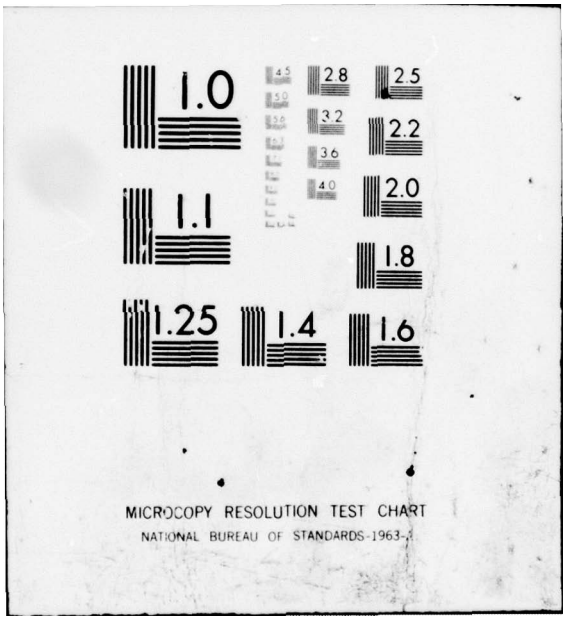
AD-A079 002 GAI CONSULTANTS INC MONROEVILLE PA F/G 13/13
NATIONAL DAM INSPECTION PROGRAM. LAKE SOMERSET DAM (NDS I.D. NU--ETC(U)
AUG 79 B M MIHALCIN DACW31-79-C-0013
UNCLASSIFIED NL



END
DATE FILMED
2-80
DDC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

[redacted]

LAKE SOMERSET DAM

LEVEL

NDS I.D. No. PA-00229
PENNDER I.D. No. 55-29

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

ORIGINAL CONTAINS COLOR PLATES: ALL DDC REPRODUCTIONS WILL BE IN BLACK AND WHITE

PREPARED FOR

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

[redacted]

[redacted]

AUGUST 1979

DISCLAIMER NOTICE

THIS DOCUMENT IS BEST QUALITY PRACTICABLE. THE COPY FURNISHED TO DDC CONTAINED A SIGNIFICANT NUMBER OF PAGES WHICH DO NOT REPRODUCE LEGIBLY.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topograhic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Lake Somerset Dam: NDI I.D. No. PA-00229

Owner: Pennsylvania Fish Commission

State Located: Pennsylvania (PennDER I.D. No. 56-89)

County Located: Somerset

Stream: East Branch of Coxes Creek

Inspection Date: 12 July 1979

Inspection Team: GAI Consultants, Inc.
570 Beatty Road
Monroeville, Pennsylvania 15146

Based on the visual inspection, operational history, and available engineering data, the dam, despite being well maintained, is considered to be in poor condition.

The size classification of the facility is intermediate and its hazard classification is considered to be high. In accordance with the recommended guidelines, the Spillway Design Flood (SDF) for this facility is considered to be the Probable Maximum Flood (PMF). Results of the hydrologic and hydraulic analysis indicate that the facility can pass and/or store approximately 72 percent of the PMF without overtopping the embankment. Thus, based on screening criteria contained in the recommended guidelines, the spillway is considered to be inadequate, but not seriously inadequate.

Observations made during the visual inspection suggest that the embankment may be structurally unsafe as extensive areas of seepage were noted on the downstream embankment slope and immediately below the toe area to the right of the outlet conduit. Seepage conditions became evident shortly after reservoir filling and have persisted in spite of the installation of a remedial sand drain system near the toe.

Failure of the embankment does not appear imminent and the

condition is presently considered non-emergency. It is recommended that the owner immediately develop and implement a warning system to notify downstream inhabitants should hazardous conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

In addition, it is recommended that the owner immediately:

a. Retain the services of a professional engineer, experienced in the design and construction of earth dams, to study the embankment and assess the effects of the seepage conditions on embankment stability under all possible operating conditions (including earthquake loading) and make remedial recommendations as deemed necessary. The study should include (but should not be limited to) drilling, soils testing to establish actual engineering properties, instrumentation, and an assessment of the effects of reservoir drawdown to a safe operating level which should be maintained until remedial studies and/or repairs are completed.

b. Inspect the facility on a daily basis until remedial studies and/or measures are completed with particular emphasis and interest given to conditions at the downstream toe.

c. Formalize manuals of maintenance and operation as planned.

(6) National Dam Inspection Program. Lake Somerset Dam (NDS I.D. Number PA-00229, PennDer I.D. Number 56-89), Ohio River Basin, East Branch of Coxes Creek, Somerset County, Pennsylvania. Phase I Inspection Report.

(15) DACW31-79-C-0013

(11) Aug 79 (12) 85

(10) Bernard M. Minatcin

411 002

GAI Consultants, Inc.

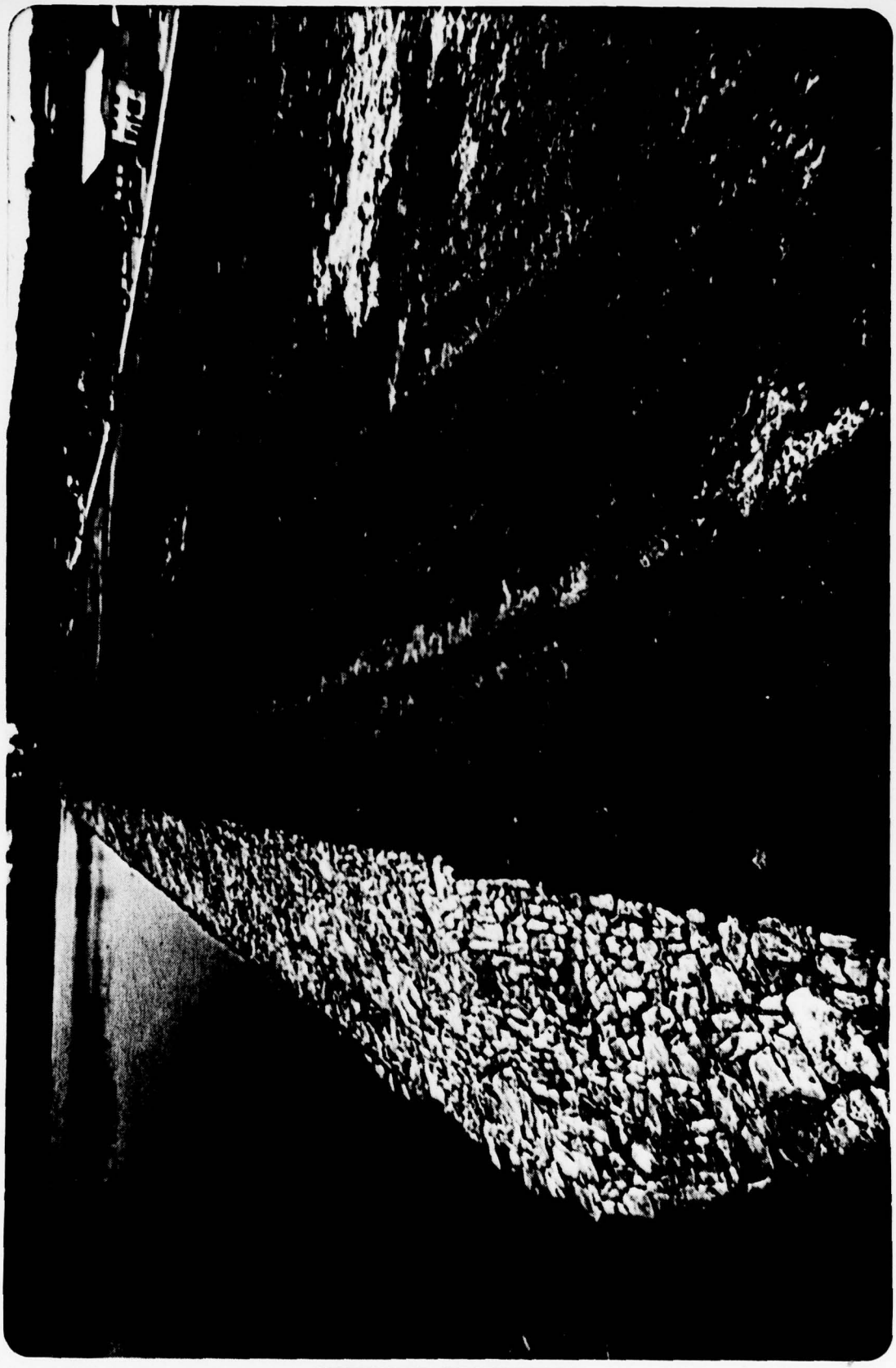
Bernard M. Mihalcin, P.E.

Date 27 August 1979

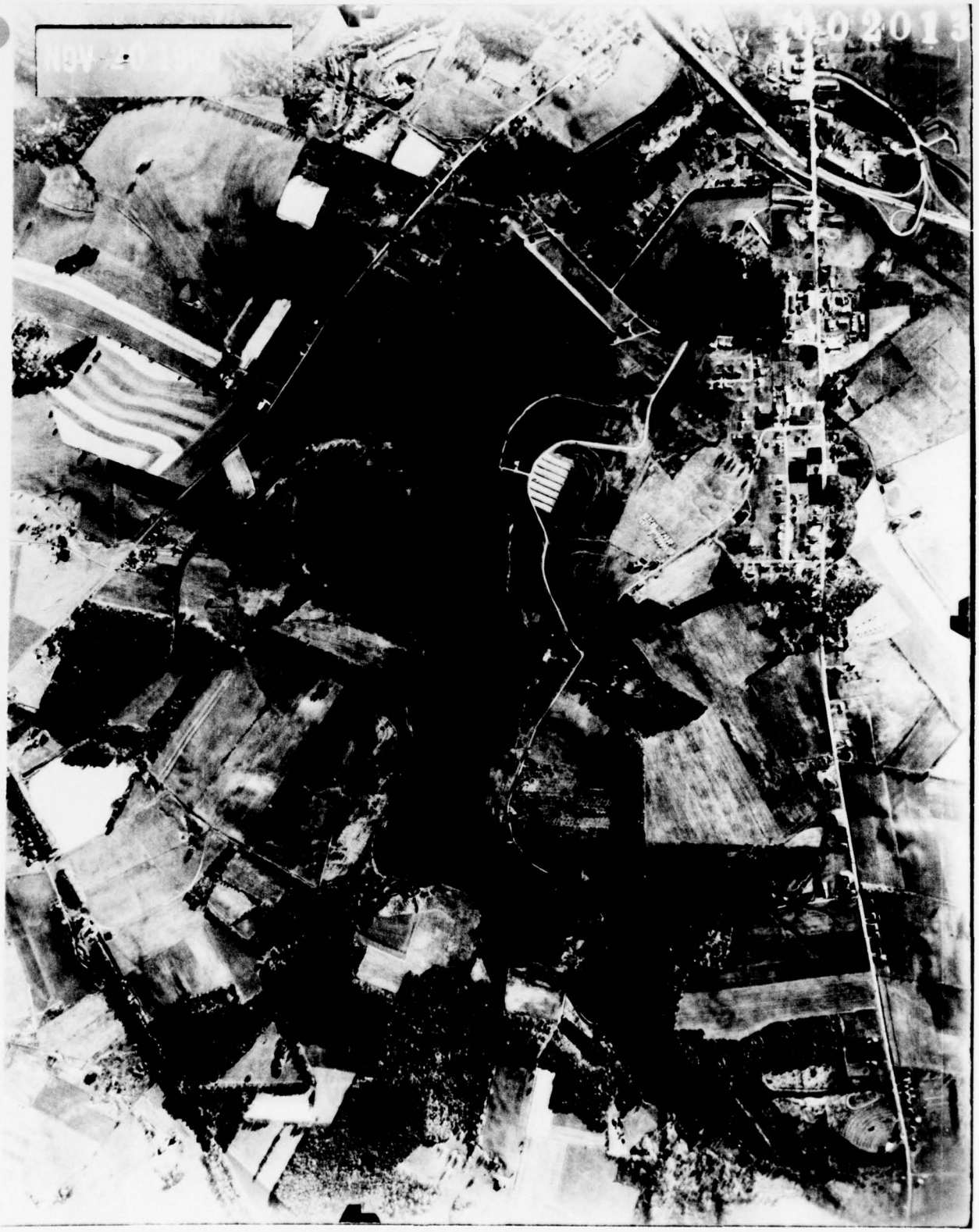
Approved by:

JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

Date 18 Sep 79



OVERVIEW PHOTOGRAPH



AERIAL PHOTOGRAPH

TABLE OF CONTENTS

TABLE OF CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE SOMERSET DAM
NDI# PA-00229, PENNDER# 56-89

SECTION 1
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Lake Somerset Dam is a zoned earth embankment approximately 25 feet high and 1,550 feet long (including spillway).

The facility is served by a concrete chute spillway with an ogee-like weir located near the left abutment. The outlet works consists of a 3-foot square (inside dimension) reinforced concrete box culvert. Outlet control is provided by a concrete tower fitted with a stop log mechanism.

b. Location. Lake Somerset Dam is located across the East Branch of Coxes Creek about 1-1/4 miles northeast of the Borough of Somerset, in Somerset Township, Somerset County, Pennsylvania. Discharge from the spillway and outlet works passes beneath Township Road 555 about 300 feet downstream of the dam (see Figure 2, Appendix F). The dam and reservoir are located within the Somerset, Pennsylvania, U.S.G.S. 7.5 minute topographic quadrangle (see Appendix G). The coordinates of the dam are N40° 0.7' and W79° 3.4'.

c. Size Classification. Intermediate (25 feet high, 2,730 acre-feet storage capacity at top of dam).

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Pennsylvania Fish Commission
P. O. Box 1673
Harrisburg, Pennsylvania 17120

f. Purpose. Public fishing.

g. Historical Data. Lake Somerset Dam was constructed in 1956 by the Pennsylvania Fish Commission (PFC). Design of the facility was undertaken by the PFC engineering staff with the aid of The Neilan Engineers of Somerset, Pennsylvania, in water balance studies.

Excessive seepage and sand boils immediately below the downstream toe became of concern in 1957 when the PFC undertook a brief seepage study. The study resulted in the installation of ninety-five 16-inch diameter sand drains ranging in depth from 5 to 10 feet along the embankment toe to the right of the outlet conduit. The drains are connected to a 4-inch diameter drain pipe that empties into the outlet channel downstream of the dam. Several sand boils were capped with inverted filters to permit drainage and control piping.

No significant alterations or remedial work has reportedly been performed since the sand drain installation.

1.3 Pertinent Data.

a. Drainage Area (square miles). 4.0

b. Discharge at Dam Site.

Discharge Capacity of Outlet Conduit - Discharge curves are not available.

Discharge Capacity of Spillway at Maximum Pool ≈ 3670 cfs (see Appendix C, Sheet 9).

c. Elevations (feet above mean sea level). The following elevations were obtained from available drawings and through field measurements that were based on the elevation of the spillway crest at 2113.0 feet.

Top of Dam	2119.0
Maximum Design Pool	Not known
Maximum Pool of Record	Not known
Normal Pool	2113.0
Spillway Crest	2113.0

Upstream Inlet Invert	2095
Downstream Outlet Invert	2094
Streambed at Dam Centerline	2094
Maximum Tailwater	Not known

d. Reservoir Length (feet).

Top of Dam	8200
Normal Pool	8000

e. Storage (acre-feet).

Top of Dam	2730
Normal Pool	1000
Design Surcharge	Not known

f. Reservoir Surface (acres).

Top of Dam	324
Normal Pool	253
Maximum Design Pool	Not known

g. Dam.

Type	Rolled earth with hand placed stone rip-rap.
Length	1550 feet (including spillway).
Height	25 feet (field measured: crest to invert of outlet conduit).
Top Width	12 feet
Upstream Slope	3H:1V
Downstream Slope	2-1/2H:1V
Zoning	Upstream two-thirds of dam constructed of selected impervious fill (class "A"). Downstream one-third of dam constructed of material "sufficiently pervious to drain the embankment"

		(class "B"; see Figure 3, Appendix F).
	Impervious Core	See "Zoning" above.
	Cutoff	3-foot deep cut-off (key) indicated on Figure 3. Not extended to sound bedrock.
	Grout Curtain	None indicated.
h.	Diversion Canal and Regulating Tunnels.	None.
i.	Spillway.	
	Type	Concrete chute with uncontrolled ogee-like weir crest located near left abutment.
	Crest Elevation	2113.0 feet.
	Crest Length	68.0 feet.
j.	Outlet Works.	
	Type	3-foot square reinforced concrete box culvert with 1-foot thick walls on 7-foot wide base.
	Conduit Length	120 feet (inlet to outlet).
	Closure and/or Regulating Facilities	Regulated with stop logs in concrete control tower located along upstream slope of dam.
	Access	Control tower accessible from crest.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Design Data Availability and Sources. There are no formal design reports for the facility. Calculations are available from PFC files which deal primarily with hydrology and structural design aspects of the concrete appurtenances. Other pertinent data in PFC files include:

1) Cost-benefit and water balance studies by The Neilan Engineers of Somerset, Pennsylvania.

2) Driller's logs (borings) and a memorandum based on a field reconnaissance and evaluation of the proposed dam site by PennDER (Department of Forest and Waters) personnel.

3) Plan, locations and descriptions of 11 hand-dug test holes along proposed outlet conduit locations (see Figure 6).

4) Design drawings and specifications.

5) Detailed photographs indicating seepage, sand boils, and construction of remedial measures in 1957.

6) As-built drawing showing location and profile of 95 sand drains installed in 1957 and descriptions of each auger hole (see Figure 7). A one page narrative dated June 26, 1957, describes a dye study and above remedial work.

PennDER files also contain a review report for construction permitting which discusses the design aspects of the facility.

b. Design Features.

1. Embankment. Specifications and contract drawings indicate that the embankment is a zoned, rolled earth structure, 25 feet high having a length of 1550 feet. The embankment contains a shallow cut-off trench 3 feet deep and 10 feet wide at its base with 1H:1V side slopes (See Figure 3).

The upstream embankment slope is 3H:1V and is protected by an 18-inch layer of hand placed stone riprap that extends from 3 feet below normal pool level to the crest. The

embankment crest is 12 feet wide and the downstream slope is 2-1/2H:1V.

There are two designated embankment zones. The upstream two-thirds of the embankment is comprised of class "A" material which is defined as "selected impervious and structurally sound material free from vegetable matter and stones greater than 6 inches in maximum dimension." The downstream one-third of the dam is comprised of class "B" material which is defined as "structurally sound material sufficiently pervious to drain the embankment and may contain stones but no vegetable matter."

No internal drainage features are included in the structure.

2. Appurtenant Structures

a) Spillway. The spillway is a reinforced concrete chute structure with an ogee-like weir located near the left abutment (see Figure 3). The crest length of the weir is 68 feet. Maximum flow depth over the weir is 6 feet and the forebay depth is 3 feet.

The spillway slab is supported on foundations extending into natural soil. Granular subbase, underdrain pipes, and various expansion joints are provided.

b) Outlet Works. The outlet works consists of a 3-foot square (inside dimension) concrete box culvert and a concrete control tower with flow regulated by stop logs (see Figure 5). The box culvert is supported on a 7-foot wide concrete base and is provided with four concrete anti-seep collars. The section downstream of the control tower also contains an expansion joint.

The inlet end of the culvert is equipped with a trash screen. Access to the control tower is through a hinged and locked floor plate.

c. Design Data and Procedures.

1. Embankment. No specific design data in the form of soil parameters, seepage or stability analyses are available for the embankment.

2. Appurtenant Structures. Available design calculations deal primarily with estimating water balance and structural design of reinforced concrete members. Design procedures were taken from well known publications

including "Design of Small Dams," by the U. S. Bureau of Reclamation, and "Concrete Culverts and Conduits," by the Portland Cement Association.

2.2 Construction Records.

Weekly progress reports indicating completion percentages of contract items along with time and material records are available from PFC files. Records of concrete tests by Pittsburgh Testing Laboratories are also available in PFC files which indicate adequate concrete strengths were realized. No soil test data (field or laboratory) are available.

2.3 Operational Records.

No daily operating records are kept for the facility.

2.4 Other Investigations.

PFC engineers performed a dye study in June 1957 to determine the source of seepage at the downstream toe of the dam. The study is summarized in a PFC memorandum dated June 26, 1957 and concluded that seepage did not appear to be coming from the lake.

Ninety-five, 16-inch diameter, 5 and/or 10-foot deep test holes (sand drains) were installed after the dye test program to further assess the seepage and provide positive drainage of the area (see Figure 7). Details of the drilling and remedial work are contained in PFC files. Conditions observed during the field inspection indicate the drainage system is inadequate or ineffective.

No other engineering investigations have been conducted.

2.5 Evaluation.

PennDER and PFC files contain calculations and memoranda that indicate the facility was designed, for the most part, in accordance with accepted engineering standards. The potential for downstream seepage was apparent from predesign field and subsurface investigations and the lack of provisions to control it can be questioned. The field inspection indicates that the remedial measures are inadequate and that effective zoning has not been achieved as designed.

SECTION 3
VISUAL INSPECTION

3.1 Observations.

a. General. The general appearance of the facility suggests that it is well maintained, but, is functioning inadequately. Thus, the overall condition is considered to be poor.

b. Embankment. The field inspection indicated that the embankment is well maintained (see Photographs 1 and 2), but, is considered to be in poor condition due to substantial seepage through its downstream face and in that area immediately downstream of the toe (see Photographs 3 and 4). An approximate mapping of the observed seepage is shown on Figure 1 and Photograph 3. As indicated, seepage through the embankment was evident along a line that was only about 6 feet below the pool level (normal pool) at the time of inspection. Discharge from the drains installed after reservoir filling and concentrated surface flow, all of which empty into the channel downstream of the outlet conduit, indicate clear seepage is in excess of 10 gallons per minute. No signs of instability (sloughing, and/or slumping of embankment slopes) were observed while the measured features generally conform to the design drawings.

c. Appurtenant Structures.

1. Spillway. The visual inspection revealed the spillway to be in good condition (see Photographs 11 and 12). Joints and minor structural cracks have been sealed with a bitumen filler.

2. Outlet Works. The outlet works was observed to be in excellent condition. No cracking or spalling of the visible concrete surfaces was noted (see Photographs 5, 6 and 7). Inspection of the interior of the outlet conduit revealed no structural cracking. Approximately 3/8-inch of movement was noted at the expansion joint within the outlet conduit.

d. Reservoir Area. The general area surrounding the reservoir is gentle to moderately sloped and partially wooded. Much of the shore line and watershed are cleared and/or cultivated.

e. Downstream Channel. The downstream channel is located in a broad, gently sloped, floodplain containing

many residences and business establishments (see Photograph 8). The Pennsylvania Turnpike and the Borough of Somerset are located approximately 3000 feet downstream of the dam. Extensive property damage and loss of life would likely occur due to failure of the dam. Thus, the hazard classification is considered to be high.

3.2 Evaluation.

The facility is considered to be well maintained; however, its overall condition is considered to be poor due to extensive seepage through the downstream embankment face and in the immediate downstream toe area. No slumping or sloughing of the downstream slope was observed; however, immediate investigation and remedial measures are recommended.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Normal Operating Procedure.

PFC personnel indicate that normal operating procedure is to maintain the stop log elevation at 1/2-foot above the spillway weir. The pool level is drawn down approximately 6 feet every two years to control weed growth and for fish management.

4.2 Maintenance of Dam.

The PFC is currently developing manuals of maintenance and operation for all of their facilities. Presently, maintenance is performed, as needed, on an unscheduled basis.

4.3 Maintenance of Operating Facilities.

Same as Section 4.2 (above).

4.4 Warning System.

The PFC is currently developing warning systems for all of their facilities. There is no system in effect, at this time, for Lake Somerset Dam. It is noted that the PFC maintains a field office adjacent to the right abutment of the dam and the facility is observed daily. No definite communication system has been established with the local civil defense whose headquarters are located in the County Court House at Somerset, Pennsylvania.

4.5 Evaluation.

Although not currently in effect, manuals of operation and maintenance along with a warning system are being developed by the PFC.

SECTION 5
HYDROLOGIC/HYDRAULIC EVALUATION

5.1 Design Data.

Design data and calculations are available in PFC files. The data indicate that the spillway was sized to accommodate the requirements of the Pennsylvania "C" Curve with no reduction for reservoir storage.

5.2 Experience Data.

Daily records of rainfall or spillway discharge have never been maintained at the facility. No damage to the facility has been reported from flood flows to date.

5.3 Visual Observations.

Based on visual observations, the spillway is in good condition and is well maintained. No deficiencies were observed that would indicate the spillway could not perform satisfactorily, within the limits of its design capacity, during a flood event.

5.4 Method of Analysis.

The facility has been analyzed in accordance with procedures and guidelines established by the U. S. Army, Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U. S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical capabilities of the program are briefly outlined in the preface contained in Appendix C.

5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with the procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I Investigations, the Spillway Design Flood (SDF) for Lake Somerset Dam is the PMF (Probable Maximum Flood). This classification is based on the relative size of the dam (intermediate) and the potential hazard of dam failure to downstream developments (high).

b. Results of Analysis. Lake Somerset was evaluated under near normal operating conditions. That is, the reservoir was initially at its estimated normal pool or spillway elevation of 2113 feet, with the spillway weir discharging freely. However, the usually discharging outlet conduit was assumed to be non-functional for the purpose of analysis. In any event, the flow capacity of the outlet conduit is not such that it would significantly increase the total discharge capabilities of the facility. The spillway is a concrete chute channel with discharges controlled by a concrete, ogee-like weir structure. All pertinent engineering calculations relative to the evaluation of this facility are provided in Appendix C.

Overtopping analysis (using the Modified HEC-1 Computer Program) indicated that the discharge/storage capacity of Lake Somerset Dam can accommodate only about 72 percent of the PMF (SDF) prior to the overtopping of the embankment (Appendix C, Summary Input/Output Sheets, Sheet D). The peak PMF inflow of about 8990 cfs was greatly attenuated by the discharge/storage capabilities of the dam and reservoir such that the resulting peak PMF outflow was about 6860 cfs (Summary Input/Output Sheets, Sheets B and C). Under the PMF, the embankment will be overtopped for approximately 4.7 hours, with a maximum depth of inundation equal to about 0.9 feet above the low top of dam elevation of 2119.0 feet (Summary Input/Output Sheets, Sheet D).

5.6 Spillway Adequacy.

Although Lake Somerset Dam cannot accommodate its SDF (the PMF), the possible downstream consequences of embankment failure due to overtopping were not evaluated. Breaching analysis of the dam was not performed in accordance with ETL-1110-2-234, since the facility can safely pass a flood of 1/2 PMF magnitude. Since Lake Somerset Dam cannot handle a PMF-size flood, its spillway is considered to be inadequate, but not seriously inadequate.

SECTION 6
EVALUATION OF STRUCTURAL INTEGRITY

6.1 Visual Observations.

a. Embankment. Based on visual observations, the embankment, although well maintained, is considered to be in poor condition. The deficiency of most concern is seepage through the downstream face and within the area immediately below the embankment toe to the right of the outlet conduit. Remedial measures (and studies) were undertaken in 1957; however, seepage persists today. Indications are that the condition is worsening in that available earlier correspondence does not mention seepage through the embankment, but, only below the toe.

b. Appurtenant Structures.

1. Spillway. The spillway is considered to be in good condition and well maintained. Minor structural cracks have been sealed.

2. Outlet Works. The outlet works are considered to be in excellent condition with no cracking or spalling noted on exposed concrete surfaces. Approximately 3/8-inch of movement was noted at the expansion joint within the outlet conduit.

6.2 Design and Construction Techniques.

Calculations, design drawings and construction specifications are available and indicate that the facility, for the most part, was designed and constructed in accordance with accepted engineering practice. Lack of provisions for internal drainage and seepage control, especially in light of pre-design subsurface data, is questionable.

6.3 Past Performance.

Discussions with PFC personnel indicate that the facility system has performed satisfactorily since construction. Seepage below the downstream toe became troublesome within a year after construction. Efforts to control and alleviate the condition have apparently been unsuccessful in that the condition appears to be worsening.

6.4 Seismic Stability

The dam is located in Seismic Zone No. 1 and is, thus, subject to minor earthquake induced dynamic forces. Due to the presence of fine sand and silt sized soils below the foundation of the dam, previously observed artesian conditions, and seepage throughout the toe area, it is possible that even minor earthquake forces could affect the stability of the embankment. However, no calculations and/or investigations were performed to confirm this opinion.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. Visual observations indicate that, although the facility is well maintained, the embankment suffers from a serious seepage condition along the downstream slope and toe to the right of the outlet conduit. Field measurements indicate that the seepage surfaces along the downstream slope approximately 6 feet below the normal pool level. No sloughing or slumping is evident along the embankment, but, the condition is of such a nature that the facility is considered unsafe, non-emergency.

Hydrologic and hydraulic calculations performed during this investigation indicate that the facility will pass and/or store 72 percent of the Probable Maximum Flood (PMF) prior to overtopping. Based on screening criteria supplied by the Department of the Army, Office of Chief of Engineers, the spillway is considered to be inadequate, but not seriously inadequate.

b. Adequacy of Information. The available information is considered sufficient to make a reasonable Phase I assessment of the facility.

c. Urgency. The implementation of an emergency warning system is considered urgent in light of the serious seepage condition noted during the inspection which possibly threatens the overall stability of the embankment.

d. Necessity for Additional Investigations. Detailed seepage and stability studies are considered necessary to assess the observed conditions and develop remedial measures.

7.2 Recommendations/Remedial Measure

Due to the seepage condition observed on and below the downstream slope, the facility is considered unsafe. Failure is not considered imminent; however, it is recommended that the owner immediately develop and implement a warning system to notify downstream residents in the event hazardous conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

In addition, it is recommended that the owner immediately:

a. Retain the services of a professional engineer, experienced in the design and construction of earth dams, to study the embankment and assess the effects of the seepage conditions on embankment stability under all possible operating conditions (including earthquake loading) and make remedial recommendations as deemed necessary. The study should include (but should not be limited to) drilling, soils testing to establish actual engineering properties, instrumentation, and an assessment of the effects of reservoir drawdown to a safe operating level which should be maintained until remedial studies and/or repairs are completed.

b. Inspect the facility on a daily basis until remedial studies and/or measures are completed with particular emphasis and interest given to conditions at the downstream toe.

c. Formalize manuals of maintenance and operation as planned.

APPENDIX A

CHECK LIST - ENGINEERING DATA

NAME OF DAM: Lake Somerset Dam

NDI#: PA-229 PENNDER#: 56-89

CHECK LIST
ENGINEERING DATA
PHASE I

ITEM	REMARKS NDI# PA - 229
PERSONS INTERVIEWED AND TITLE	Pennsylvania Fish Commission (PFC): E. Jon Grindall - PFC Engineer Clyde Buell - District 2 Facilities Manager
REGIONAL VICINITY MAP	See Appendix G (U.S.G.S. 7.5 minute topographic quadrangle, Somerset, Pennsylvania).
CONSTRUCTION HISTORY	Designed and constructed by PFC (construction in 1955-56). Some preliminary investigations performed by The Neilan Engineers. Various applications and construction specifications available in PennDER files. Good design and construction information available in PFC files, including set of photos detailing seepage problem at toe of dam.
AVAILABLE DRAWINGS	Set of 5 design drawings available in PennDER files. Additional drawings and sketches available in PFC files.
TYPICAL DAM SECTIONS	See Appendix F, Figure 3.
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	See Appendix F, Figure 5. See Appendix F, Figure 5. None available.

ITEM	REMARKS	NDI# PA - 229
SPILLWAY: PLAN SECTION DETAILS	 See Appendix F, Figure 4. See Appendix F, Figure 4. See Appendix F, Figure 4.	
OPERATING EQUIPMENT PLANS AND DETAILS	See Appendix F, Figure 5.	
DESIGN REPORTS	None available.	
GEOLOGY REPORTS	Available in PFC files.	
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	Design hydraulic computations available in PFC files concerning the capacities of the outlet channels. Hydrologic conputations concerning lake evaporation are also available. Stability and/or seepage analyses are not available.	
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	Test boring records as compiled by Pennsylvania Drilling Company (1955) available in PFC files. Also see Appendix F, Figure 3. Concrete testing performed by Pittsburgh Testing Laboratory with limits of 2700-3500 psi for 7-day strength, and 4500-5500 psi for 28-day strength (correspondence available in PFC files).	

ITEM	REMARKS NDI# PA - 229
BORROW SOURCES	See Appendix F, Figure 2.
POST CONSTRUCTION DAM SURVEYS	None by PFC.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	In-house study of seepage at downstream embankment toe, no formal report, but photographs detailing the seepage area are available in PFC files. Three PennDER inspection reports since construction contained in PennDER files.
HIGH POOL RECORDS	Not known.
MONITORING SYSTEMS	None.
MODIFICATIONS	Drains added in 1957 and in 1975 to transport seepage from embankment toe to outlet channel.

ITEM	REMARKS	NDI# PA 229
PRIOR ACCIDENTS OR FAILURES	None.	
MAINTENANCE: RECORDS MANUAL	No formal "Operations and Maintenance Manual" available; however, one is presently being developed.	
OPERATION: RECORDS MANUAL	See "Maintenance" above.	
OPERATIONAL PROCEDURES	No definite procedures. The reservoir is drawn down by about 6 feet every other year for fish management and weed control purposes.	
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	Emergency warning plan is currently being developed by PFC to be included in the "Operations and Maintenance Manual." Presently, there are no direct communication ties to the local civil defense, although the CD is headquartered in the Somerset courthouse.	
MISCELLANEOUS	PFC District 2 headquarters is located adjacent to the embankment.	

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

NDI ID # PA-229
PENN DER ID # 56-89

SIZE OF DRAINAGE AREA: 4.0 square miles

ELEVATION TOP NORMAL POOL: 2113 STORAGE CAPACITY: 1000 acre-feet

ELEVATION TOP FLOOD CONTROL POOL: - STORAGE CAPACITY: -

ELEVATION MAXIMUM DESIGN POOL: - STORAGE CAPACITY: -

ELEVATION TOP DAM: 2119 STORAGE CAPACITY: 2730 acre-feet

SPILLWAY DATA

CREST ELEVATION: 2113

TYPE: Concrete chute channel with concrete, ogee-shaped weir crest

CREST LENGTH: 68 feet

CHANNEL LENGTH: 130 feet

SPILLOVER LOCATION: Near left abutment

NUMBER AND TYPE OF GATES: None

OUTLET WORKS

TYPE: 3-foot square concrete conduit with control tower riser

LOCATION: Near centerline of dam

ENTRANCE INVERTS: 2095 feet

EXIT INVERTS: 2094 feet

EMERGENCY DRAWDOWN FACILITIES: Stop logs set in control tower riser

HYDROMETEOROLOGICAL GAGES

TYPE: None.

LOCATION: -

RECORDS: -

MAXIMUM NON-DAMAGING DISCHARGE: Not known

APPENDIX B

CHECK LIST - VISUAL INSPECTION

CHECK LIST
VISUAL INSPECTION
PHASE 1

NAME OF DAM Lake Somerset Dam STATE Pennsylvania COUNTY Somerset

NDI# PA - 229 PENNDER# 56-89

TYPE OF DAM Zoned Earth SIZE Intermediate HAZARD CATAGORY High

DATE(S) INSPECTION 12 July 1979 WEATHER Hot and Humid TEMPERATURE 80° @ 10:00 a.m.

POOL ELEVATION AT TIME OF INSPECTION 2113 M.S.L.

TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	OTHERS
B. M. Mihalcin	PA Fish Commission	
W. J. Veon	E. Jon Grindall	
D. L. Bonk	Clyde Buell	

RECORDED BY D. L. Bonk

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 229
SURFACE CRACKS	None observed.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None observed.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical - good. Horizontal - good.
RIPRAP FAILURES	Hand placed cut stone riprap in good condition.
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good condition.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 229
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	Extensive areas of saturation were noted in the flat area beyond the downstream embankment toe (see Figure 1, Appendix F).
ANY NOTICEABLE SEEPAGE	Substantial seepage was observed to be issuing through the downstream face of the embankment and through the flat area immediately downstream from the embankment toe. Wet or damp areas were found along the downstream face as high as elevations which were only 6' below the normal pool level. See Appendix F, Figure 1 for a field sketch which outlines the areas of concern.
STAFF GAGE AND RECORDER	None.
DRAINS	Two drains have been installed along the downstream toe to transport some of the seepage water to the outlet channel. Estimated discharge at the time or inspection was in excess of about 10 gallons per minute.

OUTLET WORKS

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 229
INTAKE STRUCTURE	Submerged, not observed.	
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	Three-foot square reinforced concrete box culvert in good condition with no cracking or spalling observed. However, a 3/8-inch joint separation was observed within the interior of the culvert about 50 feet from the outlet end.	
OUTLET STRUCTURE	Concrete headwall in good condition. No cracking or spalling observed.	
OUTLET CHANNEL	Unlined, trapezoidal-shaped channel for approximately 300 feet downstream from the embankment. Then a 48-inch diameter concrete conduit transports outflow beneath a township road.	
GATE(S) AND OPERATIONAL EQUIPMENT	None. Flow through outlet conduit is regulated via stop logs located within the control tower riser.	

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 229
TYPE AND CONDITION	Concrete chute channel with discharge controlled via a concrete ogee-like weir structure. Concrete surfaces are generally in good condition. Joints and several small cracks have been filled and sealed with bitumen.
APPROACH CHANNEL	Not applicable.
SPILLWAY CHANNEL AND SIDEWALLS	Good condition.
STILLING BASIN PLUNGE POOL	Concrete trapezoidal-shaped plunge pool in good condition.
DISCHARGE CHANNEL	Rock lined, trapezoidal-shaped channel that passes under a small steel bridge about 300 feet downstream from the embankment. Channel appears to be in good condition.
BRIDGE AND PIERS	None.
EMERGENCY GATES	None.

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 229
TYPE AND CONDITION	N/A
APPROACH CHANNEL	N/A
OUTLET STRUCTURE	N/A
DISCHARGE CHANNEL	N/A

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 229
MONUMENTATION SURVEYS	None observed.
OBSERVATION WELLS	None observed.
WEIRS	None observed.
PIEZOMETERS	None observed.
OTHERS	

ITEM	OBSERVATIONS AND/OR REMARKS NDI# PA - 229
SLOPES: RESERVOIR	Gentle to moderate, and primarily open field.
SEDIMENTATION	None observed.
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	The spillway discharges into a trapezoidal-shaped channel which flows beneath a small steel bridge located about 300 feet downstream from the dam. The stream then flows through the northeastern and eastern outskirts of the town of Somerset passing beneath a number of bridge structures, including a Pennsylvania Turnpike bridge.
SLOPES: CHANNEL VALLEY	Relatively gentle stream channel slope through the town of Somerset, becoming moderately steep near the confluence with the West Branch of Coxes Creek. Channel valley slopes are gentle to moderate, and primarily residential in the immediate downstream area.
APPROXIMATE NUMBER OF HOMES AND POPULATION	Immediately downstream from the dam is the town of Somerset with both industry and residences located near the stream. Specifically, within about 2500 feet downstream from the dam, approximately 15 to 20 structures could be affected by a floodwave produced by a dam breach. The approximate population is about 50 to 70, with a much larger population further downstream.

APPENDIX C

HYDROLOGY AND HYDRAULICS

PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: (1) the evaluation of the overtopping potential of the dam; and (2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.

c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), time(s) of the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as outlined below.

a. Development of an inflow hydrograph(s) to the reservoir.

b. Routing of the inflow hydrograph(s) through the reservoir.

c. Development of a failure hydrograph(s) based on specific breach criteria and normal reservoir outflow.

d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak, and maximum water surface elevation(s) of the failure hydrograph(s) for each location.

SUBJECT DAM SAFETY INSPECTION
LAKE SOMERSET DAM

BY WJV DATE 7-26-79 PROJ. NO. 79-617-229

CHKD. BY DLB DATE 7-31-79 SHEET NO. 1 OF 9

gai CONSULTANTS, INC
Engineers • Geologists • Planners
Environmental Specialists

DAM STATISTICS

HEIGHT OF DAM ≈ 25 FT (FIELD MEASURED)
(MEASURED FROM OUTLET INVERT)

MAXIMUM POOL STORAGE CAPACITY ≈ 2730 AC-FT (SHEET 5)
@ TOP OF DAM

NORMAL POOL STORAGE CAPACITY ≈ 1000 AC-FT (SEE NOTE 1)

DRAINAGE AREA ≈ 4.0 SQ MI

[PLANIMETERED OFF USGS 7.5 MINUTE SOMERSET, PA QUAD]

NOTE 1: NORMAL POOL STORAGE VALUE OBTAINED FROM "REPORT UPON THE APPLICATION OF PENNSYLVANIA FISH COMMISSION (FOR CONSTRUCTION OF A DAM ACROSS EAST BRANCH COXES CREEK, IN SOMERSET TOWNSHIP, SOMERSET COUNTY.

DAM CLASSIFICATION

DAM SIZE - INTERMEDIATE (REF 1, TABLE 1)
(DUE TO STORAGE CAPACITY)

HAZARD CLASSIFICATION - HIGH (FIELD OBSERVATION)

REQUIRED SDF - PMF (REF 1, TABLE 3)

SUBJECT DAM SAFETY INSPECTION
LAKE SOMERSET DAM

BY WJV DATE 7-27-79 PROJ. NO. 78-617-229

CHKD. BY DLB DATE 7-31-79 SHEET NO. 2 OF 9

gai CONSULTANTS, INC
Engineers • Geologists • Planners
Environmental Specialists

HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE ≈ 3.4 MI

L_{CA} ≈ 1.5 MI (MEASURED ALONG THE LONGEST WATERCOURSE FROM THE DAM TO THE CENTROID OF THE BASIN)

LENGTH OF RESERVOIR @ NORMAL POOL ≈ 1.6 MI

NOTE 2: VALUES OF L, L_{CA} AND RESERVOIR LENGTH ARE MEASURED FROM THE 7.5 MINUTE USGS SOMERSET, PA QUAD. ALL VARIABLES ARE DEFINED IN REF 2, IN THE SECTION ENTITLED "SNYDER SYNTHETIC UNIT HYDROGRAPH".

$C_t \approx 1.0$
$C_p \approx 0.40$

[SUPPLIED BY COE; ZONE 25 OHIO RIVER BASIN]

SINCE RESERVOIR LENGTH > L_{CA}

*t_p = SNYDER'S STANDARD LAG = $1.0 (L')^{0.6}$

WHERE L' = LENGTH ALONG LONGEST WATERCOURSE FROM THE RESERVOIR INLET TO THE DRAINAGE DIVIDE

$\therefore t_p \approx 1.0 (3.4 - 1.6)^{0.6} \approx 1.42$ HR

* AS PER BALTIMORE DISTRICT CORPS OF ENGINEERS FOR CASES WHEN THE LENGTH OF RESERVOIR ≥ L_{CA}

SUBJECT DAM SAFETY INSPECTION
LAKE SOMERSET DAM

BY WJV DATE 7-27-79 PROJ. NO. 78-617-229

CHKD. BY DLB DATE 7-31-79 SHEET NO. 3 OF 9

gai CONSULTANTS, INC
Engineers • Geologists • Planners
Environmental Specialists

RESERVOIR SURFACE AREAS

SURFACE AREA (SA) @ NORMAL POOL EL 2113 ≈ 253 AC

NOTE 3: NORMAL POOL ELEVATION ASSUMED TO BE THAT GIVEN FOR LAKE LEVEL ON USGS SOMERSET, PA QUAD, SINCE ONLY RELATIVE ELEVATIONS ARE GIVEN ON THE AVAILABLE DRAWINGS. SA @ NORMAL POOL AND @ TOP OF DAM OBTAINED BY PLANIMETERING CONTOURS ON FIG 2.

SA @ LOW TOP OF DAM EL 2119.0 ≈ 324 AC (SEE ABOVE NOTE)

SA @ EL 2140 ≈ 485 AC (PLANIMETERED FROM USGS 7.5 MINUTE SOMERSET, PA QUAD)

RESERVOIR ELEVATION @ "0" STORAGE

APPARENT MINIMUM RESERVOIR ELEVATION ≈ 2095 FT

NOTE 4: MINIMUM ELEVATION OBTAINED FROM FIG 5. ACTUAL GIVEN RELATIVE ELEVATION ≈ 62 FT

∴ SA @ EL 2095 FT ≈ 0 AC

RESERVOIR ELEVATION - STORAGE RELATIONSHIP

- ASSUME THAT STORAGE VARIES LINEARLY BETWEEN THE MINIMUM RESERVOIR ELEVATION VALUE OF 0 AC-FT AND THE NORMAL POOL VALUE OF 1000 AC-FT FOR SIMPLICITY.

SUBJECT DAM SAFETY INSPECTION
LAKE SOMERSET DAM

BY WJV DATE 7-27-79 PROJ. NO. 78-617-229

CHKD. BY DLB DATE 7-31-79 SHEET NO. 4 OF 9

gai CONSULTANTS, INC
Engineers • Geologists • Planners
Environmental Specialists

- FOR RESERVOIR ELEVATIONS ABOVE NORMAL POOL EL 2113.0, ASSUME THAT THE MODIFIED PRISMOIDAL RELATIONSHIP IS REPRESENTATIVE OF THE ACTUAL STORAGE VARIATION. THE RELATIONSHIP IS DEFINED BY:

$$\Delta V_{1-2} = {}^{h}/_{3} \left(A_1 + A_2 + \sqrt{A_1 \times A_2}\right) \qquad \text{(REF 14, PG 15)}$$

WHERE ΔV_{1-2} = INCREMENTAL VOLUME INCREASE BETWEEN ELEVATIONS 1 AND 2, IN AC-FT;
h = ELEVATION 2 - ELEVATION 1, IN FT;
A_1 = SA @ ELEVATION 1, IN AC;
A_2 = SA @ ELEVATION 2, IN AC.

SA @ ANY ELEVATION CAN BE DEFINED BY:

$$A_i = A_o + \left[{}^{\Delta SA}/_{\Delta H} \times (\text{ELEVATION}_i - \text{ELEVATION}_o)\right]$$

WHERE A_i = SA @ ELEVATION i, IN AC;
A_o = SA @ NORMAL POOL ≈ 253 AC FOR ELEVATIONS BETWEEN 2113 FT AND 2119 FT, OR SA @ TOP OF DAM ≈ 324 AC FOR ELEVATIONS > 2119 FT;
${}^{\Delta SA}/_{\Delta H}$ = RATE OF INCREASE IN RESERVOIR SA PER FOOT OF RESERVOIR RISE ≈ ${}^{(324-253)}/_{(2119-2113)}$ ≈ 11.9 AC/FT BETWEEN ELEVATIONS 2113 FT AND 2119 FT, OR ≈ ${}^{(485-324)}/_{(2140-2119)}$ ≈ 7.7 AC/FT ABOVE EL 2119 FT
ELEVATION_o = NORMAL POOL EL 2113 FT BETWEEN ELEVATIONS 2113 FT AND 2119 FT, OR = TOP OF DAM EL 2119 FT ABOVE ELEVATION 2119 FT; AND
ELEVATION_i = ELEVATION IN QUESTION, IN FT.

SUBJECT DAM SAFETY INSPECTION
LAKE SOMERSET DAM

BY WJV DATE 7-26-79 PROJ. NO. 78-617-229

CHKD. BY DLB DATE 7-31-79 SHEET NO. 5 OF 9

gai CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists

- ELEVATION - STORAGE COMPUTATION

RESERVOIR ELEVATION (FT)	* A_i (AC)	* ΔV_{1-2} (AC-FT	TOTAL VOLUME (AC-FT)
2095	0	-	0
2113	253	-	1000
2114	265	259	1259
2115	277	271	1530
2116	288	282	1812
2117	300	293	2105
2118	312	306	2411
LOW TOP OF DAM ELEVATION - 2119	324	318	2729
2120	332	328	3057
2121	339	335	3392
2122	347	343	3735

* DEFINED ON SHEET 4

PMP CALCULATIONS

- APPROXIMATE RAINFALL INDEX = 24 IN (REF 3, FIG 1)
  (CORRESPONDING TO A DURATION OF 24 HOURS AND AN AREA OF 200 SQ MI IN SOUTHWESTERN PENNSYLVANIA)

- DEPTH - AREA - DURATION ZONE #7 (REF 3, FIG 1)

- DRAINAGE AREA ≈ 4.0 SQ.MI. ⇒ ASSUME THAT DATA CORRESPONDING TO A 10 SQ.MI. AREA IS REPRESENTATIVE OF THIS BASIN:

SUBJECT DAM SAFETY INSPECTION
LAKE SOMERSET DAM
BY WJV DATE 7-27-79 PROJ. NO. 79-617-229
CHKD. BY DLB DATE 7-31-79 SHEET NO. 6 OF 9

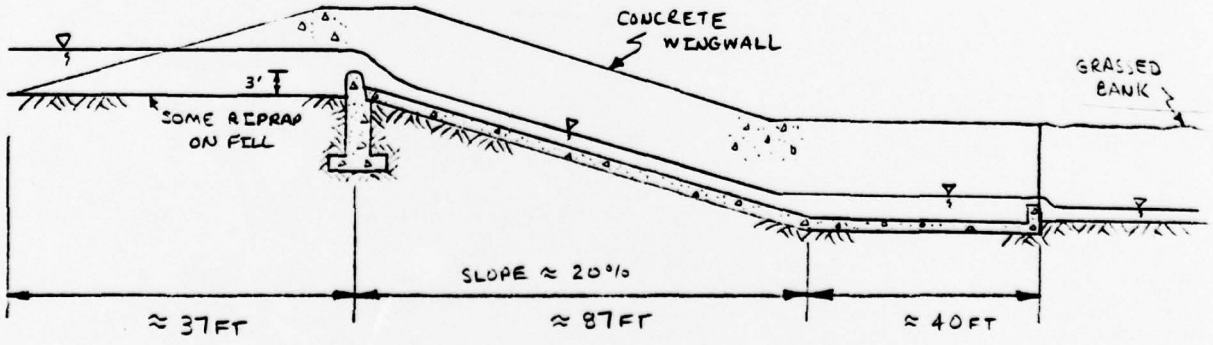
gai CONSULTANTS, INC
Engineers • Geologists • Planners
Environmental Specialists

DURATION (HR)	PERCENT OF INDEX RAINFALL (%)
6	102
12	120
24	130
48	140

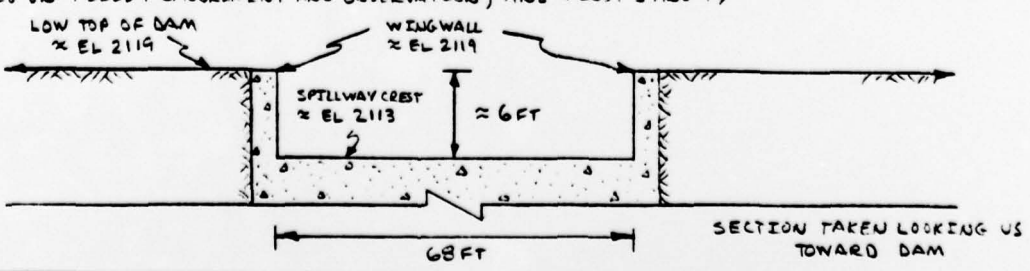
- HSP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AS WELL AS FOR THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A SMALLER BASIN) CORRESPONDING TO A DA ≈ 4.0 SQ MI ⇒ 0.80 (REF 4, PG 48)

SPILLWAY CAPACITY

- PROFILE OF SPILLWAY : (NOT TO SCALE)
(BASED ON FIELD MEASUREMENT AND OBSERVATION, AND FIG. 4)



- CROSS-SECTION OF SPILLWAY : (NOT TO SCALE)
(BASED ON FIELD MEASUREMENT AND OBSERVATION, AND FIGS. 3 AND 4)



SUBJECT DAM SAFETY INSPECTION
LAKE SOMERSET DAM

BY WJV DATE 7-27-79 PROJ. NO. 78-617-229

CHKD. BY DLB DATE 7-31-79 SHEET NO. 7 OF 9

gai CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists

- THE SPILLWAY IS A CONCRETE CHUTE CHANNEL WITH DISCHARGE CONTROLLED BY A CONCRETE OGEE-LIKE WEIR STRUCTURE. IT IS ASSUMED THAT OGEE RELATIONSHIPS ARE REPRESENTATIVE OF THE ACTUAL WEIR RELATIONSHIPS DUE TO THE SIMILAR SHAPES OF THE ACTUAL WEIR AND AN IDEALIZE OGEE WEIR. DISCHARGE IS DEFINED BY THE RELATIONSHIP:

$$Q = CLH^{3/2} \qquad \text{(REF 4, PG 373)}$$

WHERE Q = DISCHARGE IN CFS;
L = LENGTH OF WEIR CREST ≈ 68 FT;
H = HEIGHT OF RESERVOIR ABOVE SPILLWAY CREST, ASSUME DESIGN HEAD (H_o) ≈ 6 FT;
C = DISCHARGE COEFFICIENT = f(DESIGN HEAD, ACTUAL HEAD, FOREBAY DEPTH, US WEIR SLOPE, DS APRON EFFECTS, AND SUBMERGENCE).

- DETERMINATION OF DISCHARGE COEFFICIENT:

a) DESIGN HEAD ≈ 6.0 FT, FOREBAY DEPTH ≈ 3.0 FT (SHEET 6)
⇒ $P/H_o \approx 3.0\text{FT}/6.0\text{FT} \approx 0.5 \Rightarrow C_o \approx 3.90$ (REF 4, PG 378)

b) APRON EFFECTS AND SUBMERGENCE ARE ASSUMED TO BE NEGLIGIBLE DUE TO THE ELEVATION DIFFERENCE OF ABOUT 19 FT BETWEEN THE WEIR CREST AND THE STILLING BASIN, AND TO THE 20% GRADE OF THE CHUTE CHANNEL ⇒
$C_s \approx 3.90$ (REF 4, PGS 391, 392; $C_s/C \approx 1.0$)

- APPROACH CHANNEL LOSSES @ DESIGN HEAD:

① APPROXIMATE APPROACH CHANNEL WIDTH ≈ 68 FT

SUBJECT DAM SAFETY INSPECTION - LAKE SOMERSET DAM

BY WJV DATE 7-27-79 PROJ. NO. 78-617-229

CHKD. BY DLB DATE 7-31-79 SHEET NO. 8 OF 9

gai CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists

② AVERAGE APPROACH CHANNEL LENGTH ≈ 37 FT

③ MAXIMUM APPROACH CHANNEL DEPTH @ LOW TOP OF DAM EL 2119 ≈ HEAD ABOVE WEIR CREST (6 FT) + FOREBAY DEPTH (3 FT) ≈ 9 FT

④ AVERAGE WINGWALL HEIGHT @ EL 2119 ≈ 5.4 FT (FIG 4)

APPROXIMATE FOREBAY FLOW PER FOOT OF SECTION WIDTH:

$$q \approx C H^{3/2} \approx (3.8)(6)^{3/2} \approx 55.9 \text{ CFS/FT}$$

∴ APPROACH CHANNEL VELOCITY = $v_a \approx q/H_o + P$ (FOR RECTANGULAR CHANNEL SECTION)
$\approx 55.8 \text{ CFS/FT} / 9 \text{ FT} \approx 6.2 \text{ FPS}$

⇒ APPROACH VELOCITY HEAD = $h_a \approx v_a^2/2g \approx (6.2 \text{ FPS})^2/2g$
$\approx 0.60 \text{ FT}$

⇒ APPROACH CHANNEL ENTRANCE LOSS $\approx 0.1\, h_a$ (REF 4, PG 379)
$\approx 0.06 \text{ FT}$

APPROACH CHANNEL FRICTION LOSS = $h_f \approx \left[v_a n / 1.49 R_h^{2/3} \right]^2 \times L_c$
(REF 4, PG 379)

WHERE L_c = AVERAGE LENGTH OF APPROACH CHANNEL ≈ 37 FT
n = MANNINGS ROUGHNESS COEFFICIENT ≈ 0.04 (REF 7, PG 112; COBBLE BOTTOM, CLEAN SIDES);
R_h = HYDRAULIC RADIUS = FLOW AREA / WETTED PERIMETER;
FLOW AREA ≈ 68 FT (WIDTH) × 9 FT (DEPTH) ≈ 612 FT²
WETTED PERIMETER ≈ 68 FT (SECTION BOTTOM) + [2 × 5.4 FT] (SECTION SIDES; WINGWALLS) ≈ 78.8 FT
⇒ $R_h \approx 612 \text{ FT}^2 / 78.8 \text{ FT} \approx 7.8 \text{ FT}$

∴ $h_f \approx 37 \text{ FT} \times \left[(6.2 \text{ FPS})(0.04) / 1.49 (7.8)^{2/3} \right]^2 \approx 0.07 \text{ FT}$

gai CONSULTANTS, INC.
Engineers • Geologists • Planners
Environmental Specialists

⇒ EFFECTIVE HEAD ABOVE CREST = DESIGN HEAD − APPROACH CHANNEL LOSSES

≈ 6.0 FT − 0.06 FT − 0.07 FT ≈ 5.97 FT

- FLOW CAPACITY OF SPILLWAY :

$$Q = CLH^{3/2} \approx (3.80)(68\,FT)(5.97\,FT)^{3/2} \approx 3670\,CFS$$

SPILLWAY RATING CURVE

COMPUTED INTERNALLY BY HEC-1 VIA THE OGEE RATING CURVE ROUTINE. THE OGEE ROUTINE COMPUTES DISCHARGES IN A WAY SIMILAR TO THAT PRESENTED ON SHEETS 7 THROUGH 9, BASED ON THE INPUTS: DESIGN HEAD ≈ 6.0FT, APRON ELEVATION ≈ 2094 FT (FIG 4), APRON WIDTH ≈ 51FT, APPROACH CHANNEL LOSS @ DESIGN HEAD ≈ 0.13FT, AND FOREBAY DEPTH ≈ 3FT.

EMBANKMENT RATING CURVE

- FLOWS OVER THE EMBANKMENT WILL BE COMPUTED INTERNALLY BY HEC-1 VIA THE ASSUMPTION THAT CRITICAL DEPTH OCCURS ON THE CREST W/ THE CREST PROFILE REPRESENTED BY A SERIES OF TRAPEZOIDS. (SEE SUMMARY INPUT/OUTPUT SHEETS FOR RATING INFORMATION).

- INPUT INFORMATION : (BASED ON FIELD MEASUREMENTS)

RESERVOIR ELEVATION (FT)	DEPTH ABOVE CREST (FT)	LENGTH OF CREST INUNDATED (FT)	RESERVOIR ELEVATION (FT)	DEPTH ABOVE CREST (FT)	LENGTH OF CREST INUNDATED (FT)
2119.0	0	200	2119.5	0.5	990
2119.1	0.1	540	2119.6	0.6	1150
2119.2	0.2	800	2119.7	0.7	1500
2119.3	0.3	940	2122.0	3.0	1580

BASED PARTLY ON LEFT ABUTMENT SS OF [illegible] (FROM U.S. TOPO MAP)

SUBJECT DAM SAFETY INSPECTION
LAKE SOMERSET DAM
OVERTOPPING

BY WJV DATE 8-3-79 PROJ. NO. 79-617-229
CHKD. BY DLB DATE 8-3-79 SHEET NO. A OF D

Engineers • Geologists • Planners
Environmental Specialists

SUMMARY INPUT / OUTPUT SHEETS

DAM SAFETY INSPECTION
COXES CREEK DAM ****** OVERTOPPING ANALYSIS ******
10-MINUTE TIME STEP AND 48-HOUR STORM DURATION

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	ISTAN
288	0	10	0	0	0	0	0	0	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1
RTIOS= .70 .80 .90 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW INTO COXES CREEK DAM RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	4.00	0.00	4.00	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	102.00	120.00	130.00	140.00	0.00	0.00

IRSPC COMPUTED BY THE PROGRAM IS .800

INITIAL AND CONSTANT RAINFALL LOSSES AS PER COE

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

UNIT HYDROGRAPH DATA
TP= 1.42 CP= .40 NTA= 0

BASE FLOW PARAMETERS AS PER COE

RECESSION DATA
STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC= 8.80 AND R=15.90 INTERVALS

SUBJECT DAM SAFETY INSPECTION

LAKE SOMERSET DAM

BY WJV DATE 8-3-79 PROJ. NO. 79-617-229

CHKD. BY DLB DATE 8-3-79 SHEET NO. 8 OF D

Engineers • Geologists • Planners
Environmental Specialists

UNIT HYDROGRAPH 89 END-OF-PERIOD ORDINATES, LAG= 1.41 HOURS, CP= .40 VOL= 1.00

26.	96.	198.	318.	448.	569.	662.	723.	740.	714.
670.	629.	591.	555.	521.	489.	459.	431.	405.	380.
357.	335.	315.	296.	278.	261.	245.	230.	216.	203.
190.	179.	168.	158.	148.	139.	131.	123	115.	108.
101.	95.	89.	84.	79.	74.	70.	65.	61.	58.
54.	51.	48.	45.	42.	39.	37.	35.	33.	31.
29.	27.	25.	24.	22.	21.	20.	19.	17.	16.
15.	14.	14.	13.	12.	11.	11.	10.	9.	9.
8.	8.	7.	7.	6.	6.	6.	5.	5.	

O MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.88	24.46	2.42	355958.
										(683.)(621.)(61.)(10079.61)			

RESERVOIR INFLOW HYDROGRAPHS

PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8986.	6467.	2397.	1234.	355282.
CMS	254.	183.	68.	35.	10060.
INCHES		15.04	22.30	22.95	22.95
MM		382.03	566.30	582.96	582.96
AC-FT		3207.	4754.	4894.	4894.
THOUS CU M		3956.	5864.	6036.	6036.

0.7 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6290.	4527.	1678.	864.	248697.
CMS	178.	128.	48.	24.	7042.
INCHES		10.53	15.61	16.07	16.07
MM		267.42	396.41	408.07	408.07
AC-FT		2245.	3328.	3426.	3426.
THOUS CU M		2769.	4105.	4225.	4225.

0.8 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7189.	5174.	1917.	987.	284225.
CMS	204.	147.	54.	28.	8048.
INCHES		12.03	17.84	18.36	18.36
MM		305.63	453.04	466.36	466.36
AC-FT		2566.	3803.	3915.	3915.
THOUS CU M		3165.	4691.	4829.	4829.

HYDROGRAPH ROUTING

ROUTE INFLOW THROUGH RESERVOIR

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
101	1	0	0	0	0	1	0	0

ROUTING DATA

OLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-2113.	2

SUBJECT DAM SAFETY INSPECTION

LAKE SOMERSET DAM

BY WJV DATE 8-3-79 PROJ. NO. 79-617-229

CHKD. BY DLB DATE 8-3-79 SHEET NO. C OF D

CAPACITY=	0.	1000.	1259.	1530.	1812.	2105.	2411.	2729.	3057.	3392.
	3735.									
ELEVATION=	2095.	2113.	2114.	2115.	2116.	2117.	2118.	2119.	2120.	2121.
	2122.									

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
2113.0	68.0	0.0	0.0	0.0	0.0	0.0	0.0

IABCOA	ISPITW	ISPCTW
10	10	10

SS	NGATES	DESHD	APEL	APWID	APLOSS	PDPTH
0.00	1	6.0	2094.0	51.0	.1	3.0

2095.00	0.	0.	0.0	0.	0.	0.0	0.	0.	0.
2113.00	1000.	0.	0.0	0.	0.	0.0	0.	0.	0.
2114.00	1259.	214.	2094.1	214.	0.	0.0	0.	214.	214.
2115.00	1530.	633.	2094.4	633.	0.	0.0	0.	633.	633.
2116.00	1812.	1212.	2094.7	1212.	0.	0.0	0.	1212.	1212.
2117.00	2105.	1932.	2095.1	1932.	0.	0.0	0.	1932.	1932.
2118.00	2411.	2781.	2095.5	2781.	0.	0.0	0.	2781.	2781.
2119.00	2729.	3728.	2096.0	3728.	0.	0.0	0.	3728.	3728.
2120.00	3057.	4753.	2096.6	4753.	0.	0.0	0.	4753.	4753.
2121.00	3392.	5824.	2097.1	5824.	0.	0.0	0.	5824.	5824.
2122.00	3735.	6929.	2097.7	6929.	0.	0.0	0.	6929.	6929.

DAM DATA

TOPEL	COQD	EXPD	DAMWID
2119.0	0.0	0.0	0.

CREST LENGTH	200.	540.	800.	940.	990.	1150.	1500.	1580.
AT OR BELOW ELEVATION	2119.0	2119.1	2119.2	2119.3	2119.5	2119.6	2119.7	2122.0

PEAK OUTFLOW IS 6861. AT TIME 43.00 HOURS

RESERVOIR OUTFLOW HYDROGRAPH

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6861.	4968.	1692.	856.	246630.
CMS	194.	141.	48.	24.	6984.
INCHES		11.55	15.74	15.93	15.93
MM		293.45	399.86	404.68	404.68
AC-FT		2463.	3357.	3397.	3397.
THOUS CU M		3039.	4140.	4190.	4190.

PMF

SUBJECT DAM SAFETY INSPECTION
LAKE SOMERSET DAM
BY WJY DATE 8-3-79 PROJ. NO. 78-C17-229
CHKD. BY DLB DATE 8-3-79 SHEET NO. D OF D

RESERVOIR OUTFLOW HYDROGRAPHS

PEAK OUTFLOW IS 3479. AT TIME 44.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3479.	3109.	1072.	543.	156456.
CMS	99.	88.	30.	15.	4430.
INCHES		7.23	9.97	10.11	10.11
MM		183.63	253.34	256.72	256.72
AC-FT		1542.	2127.	2155.	2155.
THOUS CU M		1901.	2623.	2658.	2658.

0.7 PMF

OVERTOPPING OCCURS @ ≈ 0.72 PMF

PEAK OUTFLOW IS 4286. AT TIME 43.67 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	4286.	3646.	1260.	638.	183836.
CMS	121.	103.	36.	18.	5206.
INCHES		8.48	11.72	11.88	11.88
MM		215.38	297.79	301.64	301.64
AC-FT		1808.	2500.	2532.	2532.
THOUS CU M		2230.	3083.	3123.	3123.

0.8 PMF

SUMMARY OF DAM SAFETY ANALYSIS

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	2113.00	2113.00	2119.00
STORAGE	1000.	1000.	2729.
OUTFLOW	0.	0.	3728.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.70	2118.74	0.00	2646.	3479.	0.00	44.00	0.00
.80	2119.29	.29	2823.	4286.	2.67	43.67	0.00
.90	2119.63	.63	2937.	5565.	4.00	43.33	0.00
1.00	2119.87	.87	3015.	6861.	4.67	43.00	0.00

LIST OF REFERENCES

1. "Recommended Guidelines for Safety Inspection of Dams," prepared by Department of the Army Office of the Chief of Engineers, Washington, D. C. (Appendix D).

2. "Unit Hydrograph Concepts and Calculations," by Corps of Engineers, Baltimore District (L-519).

3. "Seasonal Variation of Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Duration of 6, 12, 24, and 48 Hours," Hydrometeorological Report No. 33, prepared by J. T. Riedel, J. F. Appleby and R. W. Schloemer Hydrologic Service Division Hydrometeorological Section, U. S. Department of the Army, Corps of Engineers, Washington, D. C., April 1956.

4. Design of Small Dams, U. S. Department of the Interior, Bureau of Reclamation, Washington, D. C., 1973.

5. Handbook of Hydraulic, H. W. King and E. F. Brater, McGraw-Hill, Inc., New York, 1963.

6. Standard Handbook for Civil Engineers, F. S. Merritt McGraw-Hill, Inc., New York, 1968.

7. Open-Channel Hydraulics, V. T. Chow, McGraw-Hill, Inc., New York, 1959.

8. Weir Experiments, Coefficients, and Formulas, R. E. Horton, Water Supply and Irrigation Paper No. 200, Department of the Interior, United States Geological Survey, Washington, D. C., 1907.

9. "Probable Maximum Precipitation Susquehanna River Drainage Above Harrisburg, Pennsylvania," Hydrometeorological Report 40, prepared by H. V. Goodyear and J. T. Riedel, Hydrometeorological Branch Office of Hydrology, U. S. Weather Bureau, U. S. Department of Commerce, Washington, D. C., May 1965.

10. Flood Hydrograph Package (HEC-1) Dam Safety Version, Hydrologic Engineering Center, U. S. Army Corps of Engineers, Davis, California, July 1978.

11. "Simulation of Flow Through Broad Crest Navigation Dams with Radial Gates," R. W. Schmitt, U. S. Army Corps of Engineers, Pittsburgh District.

12. "Hydraulics of Bridge Waterways," BPR, 1970, Discharge Coefficient Based on Criteria for Embankment Shaped Weirs, Figure 24, page 46.

13. Applied Hydraulics in Engineering, Morris, Henry M. and Wiggert, James N., Virginia Polytechnic Institute and State University, 2nd Edition, The Ronald Press Company, New York, 1972.

14. Standard Mathematical Tables, 21st Edition, The Chemical Rubber Company, 1973, page 15.

15. Engineering Field Manual, U. S. Department of Agriculture, Soil Conservation Service, 2nd Edition, Washington, D. C. 1969.

APPENDIX D

PHOTOGRAPHS

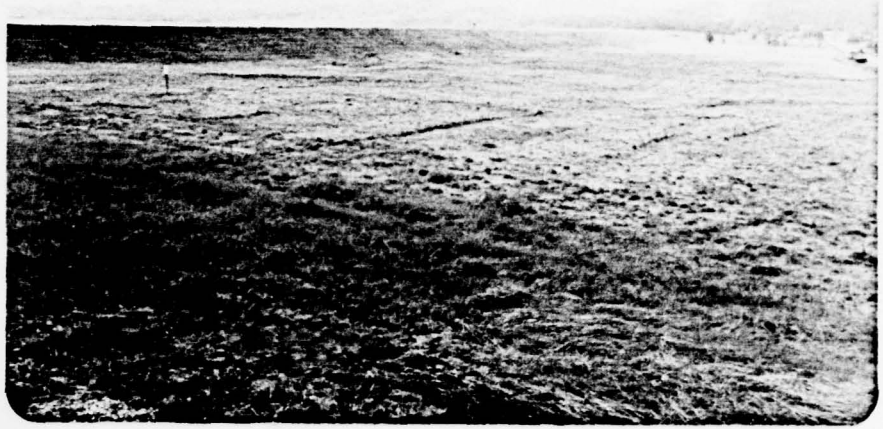
PHOTOGRAPH 1 Overview photograph of Lake Somerset Dam as seen from the right abutment.

PHOTOGRAPH 2 View of the embankment as seen from several hundred feet downstream.

PHOTOGRAPH 3 View of the downstream embankment face to the right of the outlet conduit where seepage was observed. Two black lines attached to the photograph represent the base of the slope (bottom line) and top of observed seepage (top line), respectively.

PHOTOGRAPH 4 View of a typical wet spot found along the downstream embankment toe to the right of the outlet conduit.

1



2

3

4

PHOTOGRAPH 5 View, looking northwest toward the right abutment, of the embankment crest and upstream face. The buildings in the background house the regional field office of the Pennsylvania Fish Commission.

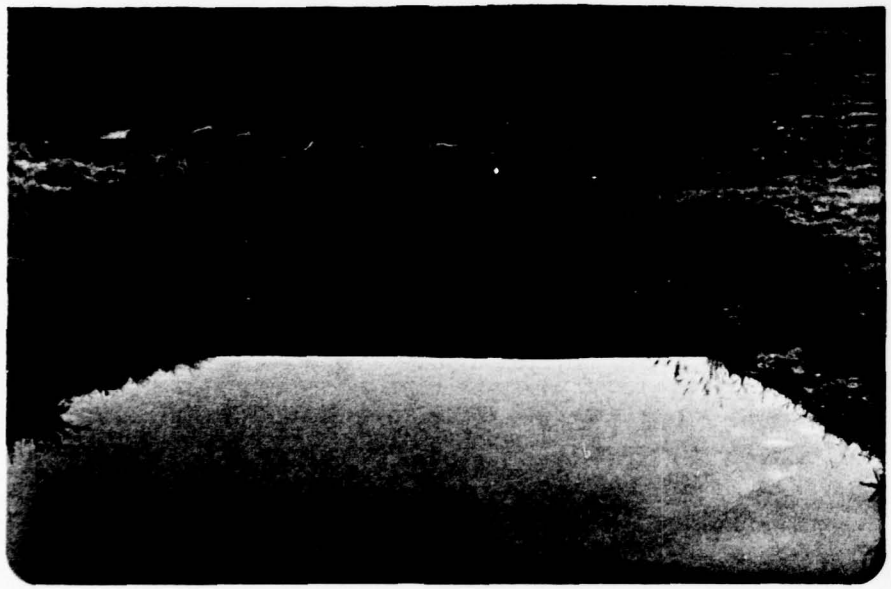
PHOTOGRAPH 6 View of the interior of the outlet conduit control tower riser.

PHOTOGRAPH 7 View of the concrete headwall at the discharge end of the outlet conduit located at the downstream embankment toe.

PHOTOGRAPH 8 View looking downstream from the embankment crest directly above the outlet conduit. The Borough of Somerset forms the horizon in the view.

5

6



7

8

PHOTOGRAPH 9 View of the embankment as seen from the left abutment.

PHOTOGRAPH 10 View of the spillway as seen from Township Road 555 downstream.

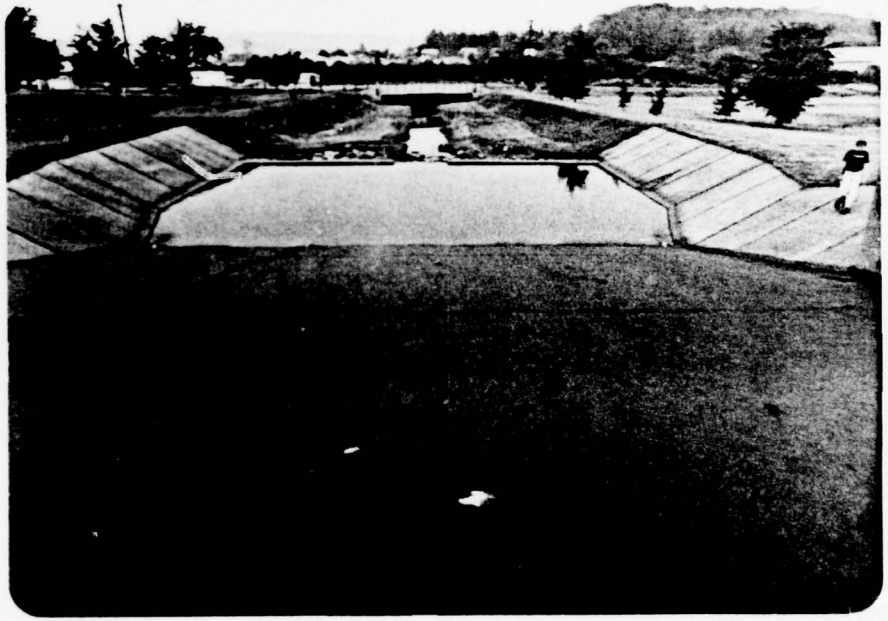
PHOTOGRAPH 11 View of the spillway overflow weir.

PHOTOGRAPH 12 View looking downstream from the spillway crest.

9

10

11



12

APPENDIX E

GEOLOGY

Geology

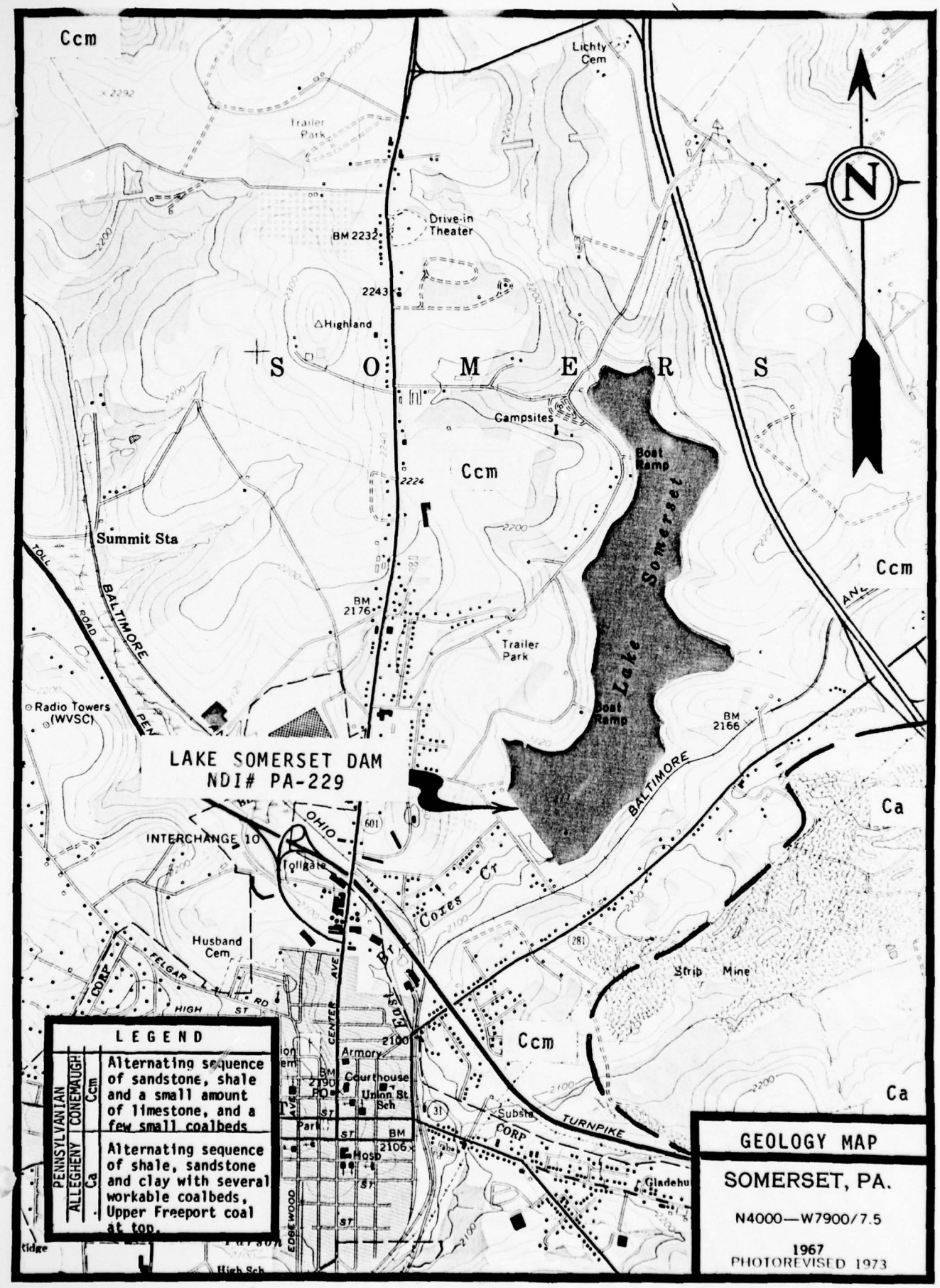
Lake Somerset Dam is located immediately northeast of the community of Somerset, Pennsylvania, in the Allegheny Mountain Section of the Appalachian Plateaus Physiographic Province. The Allegheny Mountain Section is characterized by gently folded sedimentary rock strata of Pennsylvanian age or older. Major structural axes strike from southwest to northeast with flanking strata dipping northwest and southeast.

Structurally, the dam and reservoir lie approximately 13 miles west of the Allegheny Front on the eastern flank of a northeast-southwest trending Somerset syncline. The strata underlying the alluvial and residual soils at the dam site are members of the Pennsylvanian Age Conemaugh Formation. The Conemaugh Formation is characterized as a variable sequence of sandstone, shale, clay, thin coal seams (locally workable) and thin beds of limestone. A productive water source in Somerset County, the Conemaugh contains several sandstone members that yield as much as 250 gpm.

A memorandum in PennDER files indicated that the overburden varies from 5 to 14 feet along the axis of the dam and consists primarily of silty clay. Immediately above the bedrock; the investigators noted a clayey or silty sand layer varying from 1 to 3 feet thick. In most of the holes, bedrock consisted of a fine to medium grained sandstone thought to be the Mahoning sandstone member of the Conemaugh

Formation. They also noted that one of the boreholes near the proposed stilling basin showed slight artesian pressure. The investigators presumed that the aquifer involved in the artesian conditions was at the bedrock level where the materials showed tan discoloration. The existence of artesian conditions was reinforced when three sand boils were discovered prior to construction near the proposed toe, and the dam was relocated some 50 feet further upstream (see Figure 6).

Following construction, and upon filling the reservoir, the sand boil condition worsened. Inverted filters were used to remedy the problem, and no sand boils were observed at the time of inspection.


Ccm
Lichty Cem
Trailer Park
Drive-in Theater
BM 2232
2243
△Highland
S O M E R S
Campsites
Boat Ramp
Lake Somerset
2224
Ccm
Summit Sta
TOLL ROAD
BALTIMORE
BM 2176
Trailer Park
Ccm
Radio Towers (WVSC)
LAKE SOMERSET DAM
NDI# PA-229
Boat Ramp
BM 2166
BALTIMORE
Ca
INTERCHANGE 10
OHIO
601
Tollgate
Coxes Cr
Husband Cem
FELGAR
CORP
HIGH ST
CENTER AVE
BALTIMORE ST
281
Strip Mine
Ccm
2100
Armory
Courthouse
Union St Sch
BM 2190
Park
BM 2106
Hqsb
Substa
CORP
TURNPIKE
Ca
Gladehu
EDGEWOOD
High Sch
N
LEGEND
PENNSYLVANIAN
ALLEGHENY
CONEMAUGH
Ccm
Alternating sequence of sandstone, shale and a small amount of limestone, and a few small coalbeds
Ca
Alternating sequence of shale, sandstone and clay with several workable coalbeds, Upper Freeport coal at top.
GEOLOGY MAP
SOMERSET, PA.
N4000—W7900/7.5
1967
PHOTOREVISED 1973

APPENDIX F

FIGURES

LIST OF FIGURES

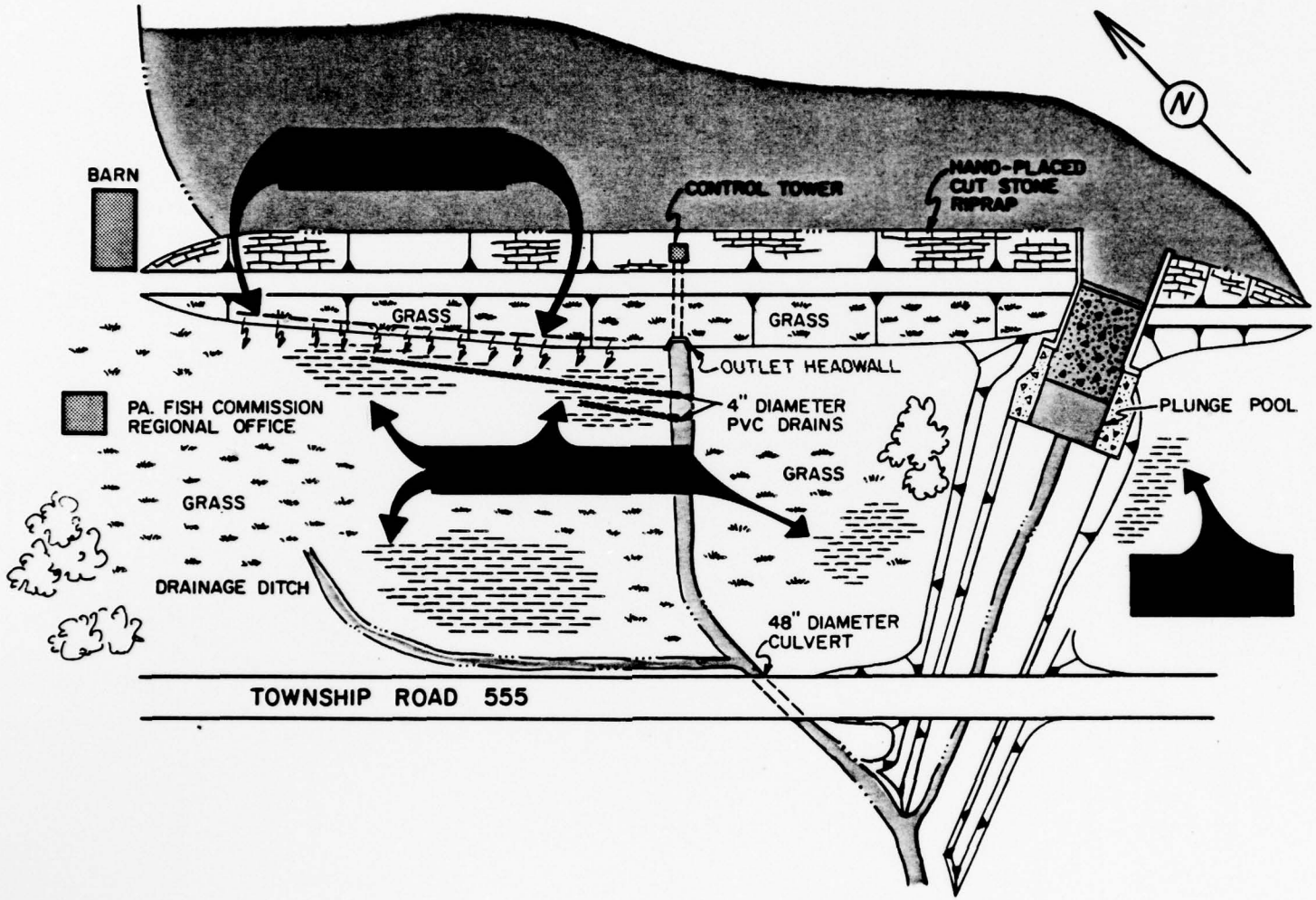
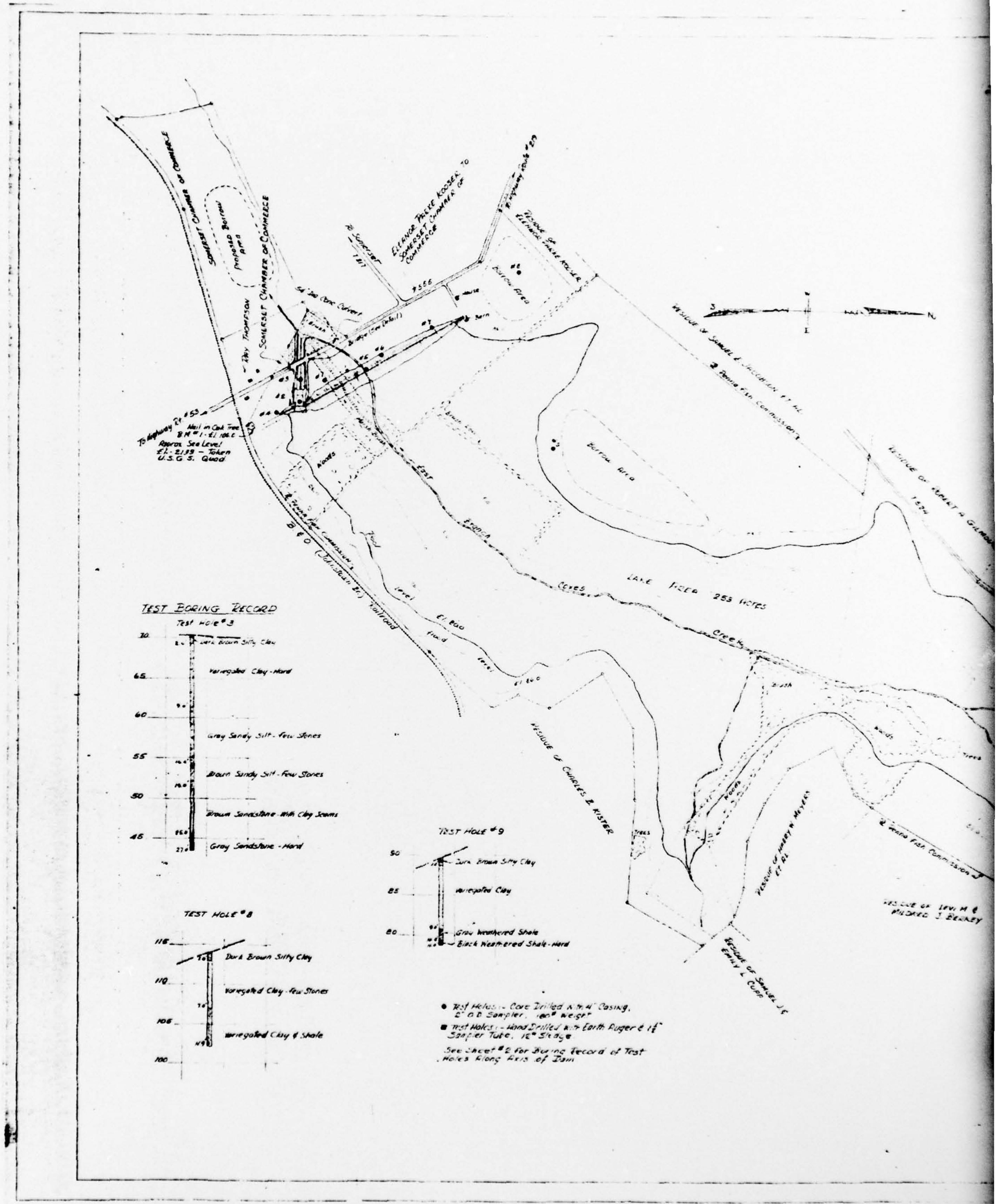
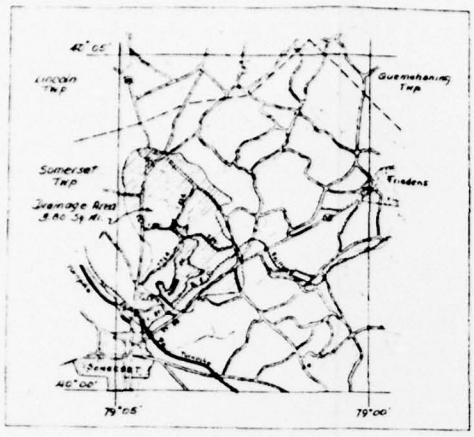


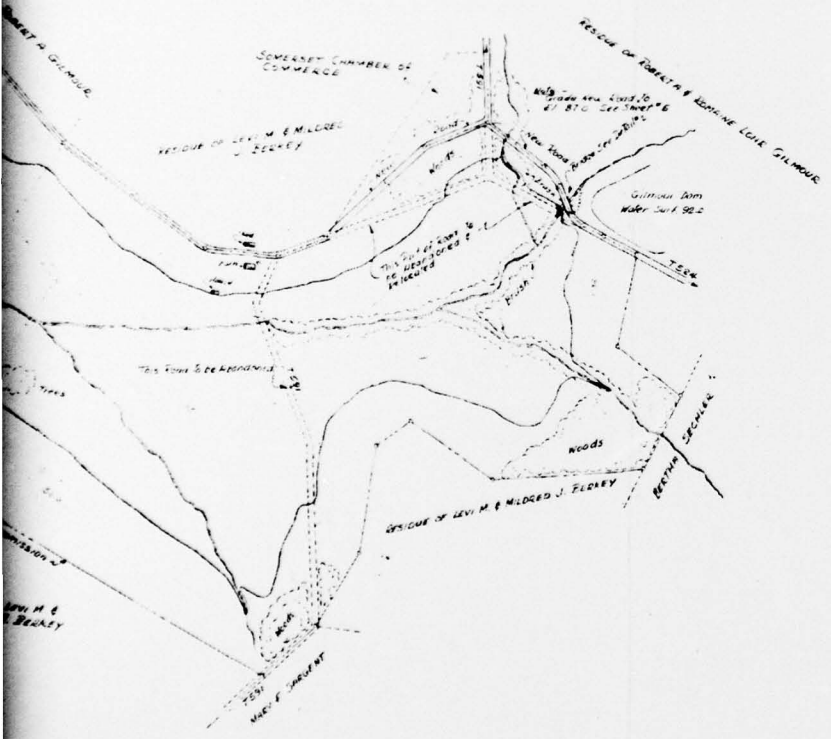
FIGURE 1 - LAKE SOMERSET DAM

GENERAL PLAN : FIELD INSPECTION NOTES


Somerset Chamber of Commerce
Proposed Borrow Area
Ray Thompson
Somerset Chamber of Commerce
Eleanor Teske Kooser to Somerset Chamber of Commerce
Residue of Eleanor Teske Kooser
Borrow Area
Residue of Samuel J. Jacobson et al.
To Highway Rt #53
Nail in Oak Tree
BM #1 - El 106.0
Approx. Sea Level
El. 2139 - Taken U.S.G.S. Quad
Woods
Borrow Area
Lake Area 253 Acres
Coxes Creek
B & O (Johnstown Br.) Railroad
Penna Fish Commission
El 800
Residue of Charles E. Kister
Trees
Residue of Harry W. Meyers et al.
Residue of Samuel J. S. Emily L. Cupp
Residue of Levi M. & Mildred J. Berkey
TEST BORING RECORD
Test Hole #3
70
65
60
55
50
45
Dark Brown Silty Clay
Variegated Clay - Hard
Gray Sandy Silt - Few Stones
Brown Sandy Silt - Few Stones
Brown Sandstone - With Clay Seams
Gray Sandstone - Hard
TEST HOLE #9
90
85
80
Dark Brown Silty Clay
Variegated Clay
Gray Weathered Shale
Black Weathered Shale - Hard
TEST HOLE #8
115
110
105
100
Dark Brown Silty Clay
Variegated Clay - Few Stones
Variegated Clay & Shale
● Test Holes - Core Drilled with 4" Casing, 2" O.D. Sampler, 140# Weight
■ Test Holes - Hand Drilled with Earth Auger & 1½" Sampler Tube, 12" Stage
See Sheet #2 for Boring Record of Test Holes Along Axis of Dam

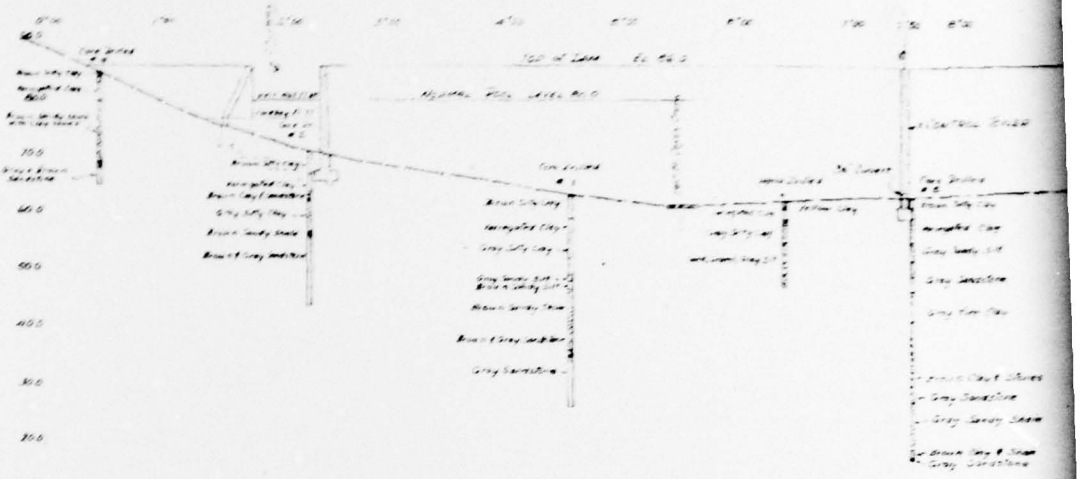


LOCATION PLAN
1" = 1 mile

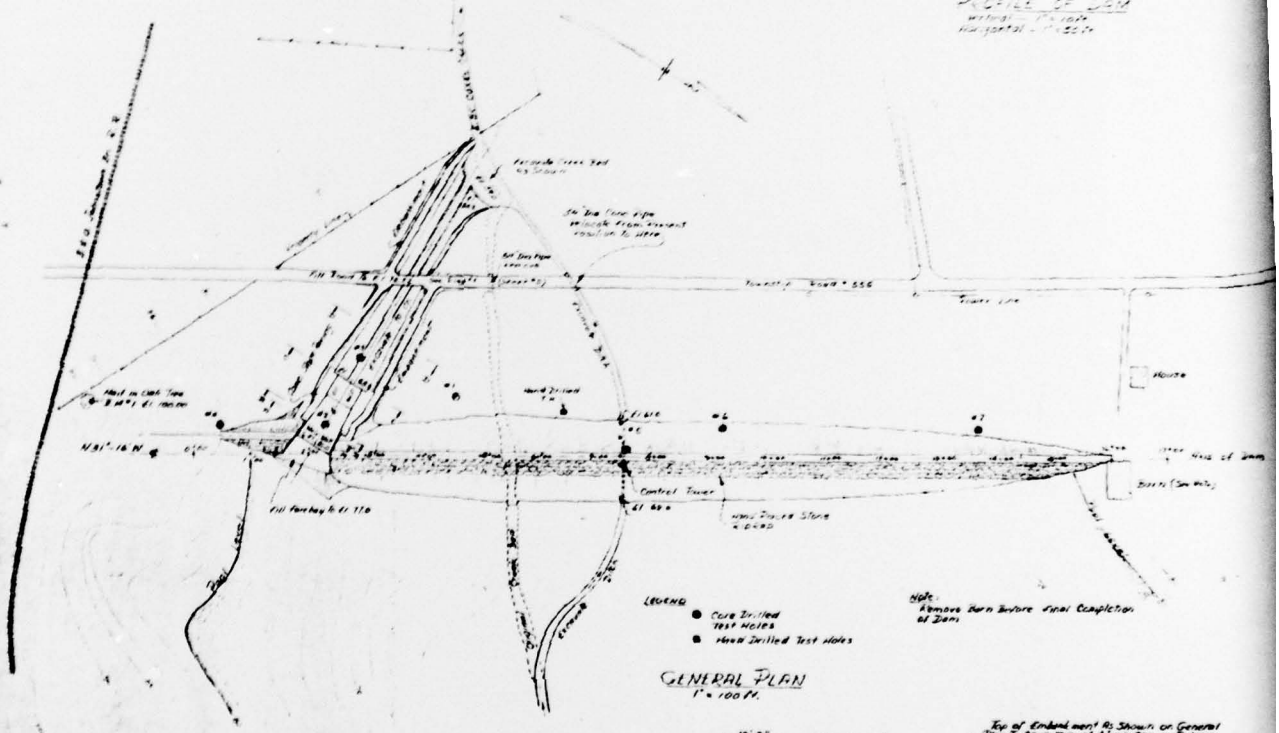


REVISED	APPROVALS	PROJECT NO P-1873-1
	APPROVED APPROVAL DEPT. COMMISSIONER APPROVED FOR DEPT SUBMITTED BY ACCEPTED BY CONTRACTOR BY BUREAU OF ENGINEERING & CONSTRUCTION CHECKED BY ARCH. STRUCT. MECH. ELEC.	TOPOGRAPHY MAP SOMERSET LAKE & DAM EAST BRANCH COXE'S CREEK SOMERSET TOWNSHIP, SOMERSET CO. PA. T.F. O'HARA — REGISTERED ENGINEER STATE COLLEGE, PENNA. DATE COMMONWEALTH OF PENNSYLVANIA GEO M. LEADER - GOVERNOR DEPT. OF PROPERTY & SUPPLIES Wm. D. THOMAS - SECRETARY HARRISBURG, PENNSYLVANIA SCALE 1" = 200 FT. SHEET NO. 1

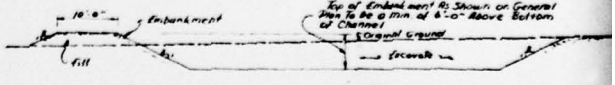
FIGURE 2



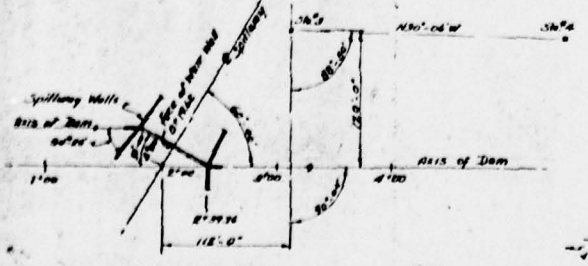
PROFILE OF DAM



GENERAL PLAN
1" = 100 Ft.

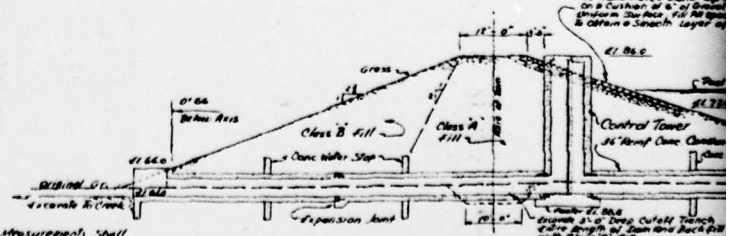


SECTION D-D
1" = 10'-0"

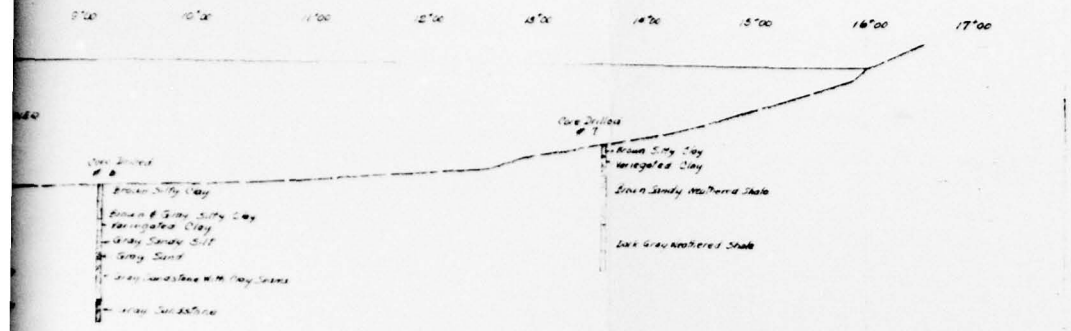


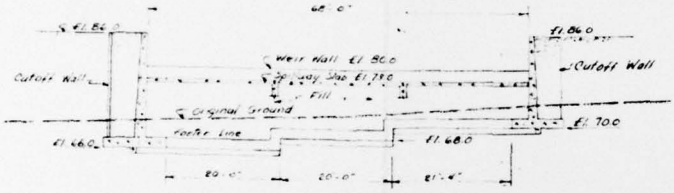
LOCATION PLAN
1" = 400'

NOTE:-
All Dimensions and Measurements Shall be Checked and Verified by the Contractor at the Site.

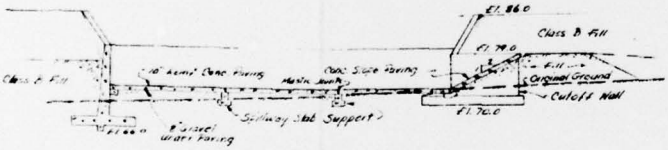


SECTION THRU DAM at CONTROL TOWER
1" = 40'-0"

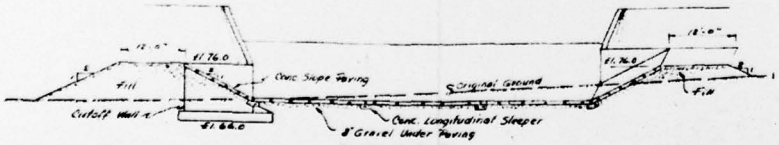




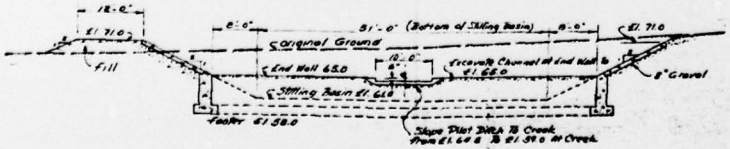
SECTION ALONG WEIR WALL
1" = 10ft.



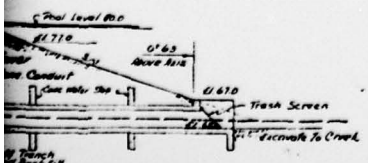
SECTION A-A
1" = 10ft.



SECTION B-B
1" = 10ft.

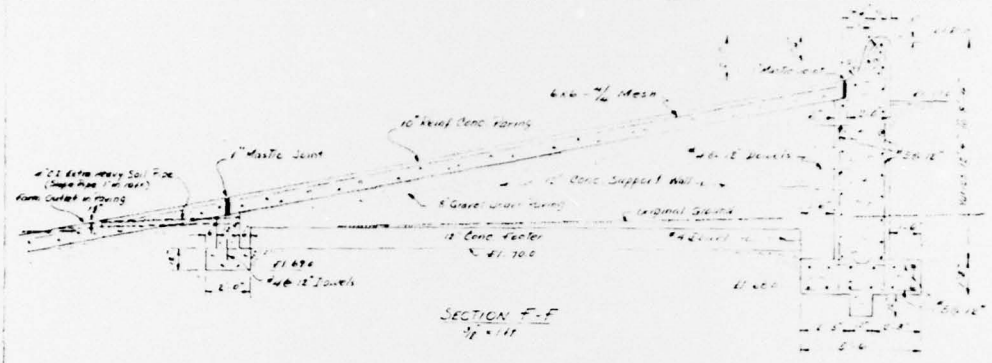


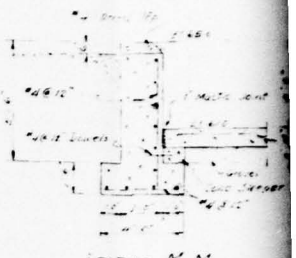
SECTION C-C
1" = 10ft.

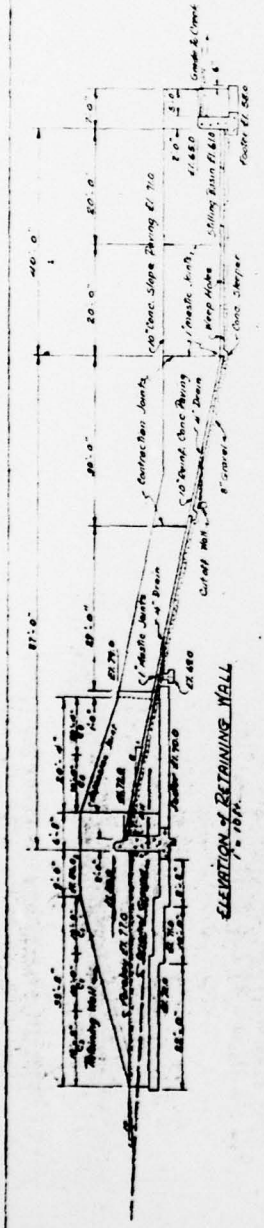


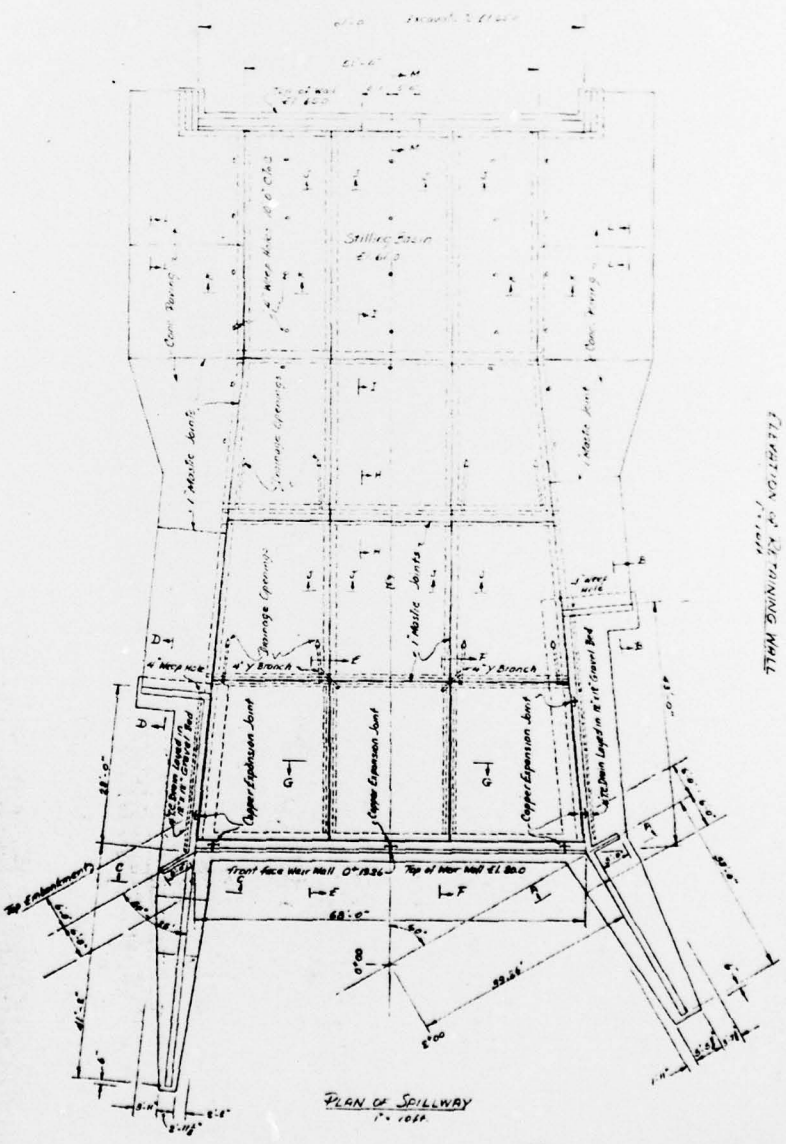
REVISED	APPROVALS	PROJECT NO. P-1873-1
	APPROVED Chief of Engineering & Construction	GENERAL PLAN & SECTIONS
	APPROVAL RECOMMENDED Supervising Architect, Bureau of Construction	SOMERSET LAKE & DAM. EAST BRANCH COKE'S CREEK, SOMERSET TOWNSHIP, SOMERSET CO. PA.
	APPROVED FOR DEPT. Chief, Flood Control Division	T. F. O'HARA — REGISTERED ENGINEER STATE COLLEGE, PENNA.
	SUBMITTED BY Thomas F. O'Hara, Engineer	DATE
	ACCEPTED BY Contractor	SCALE NOTED
	BY	COMMONWEALTH OF PENNSYLVANIA Gov. M. LEADER—GOVERNOR DEPT. OF PROPERTY & SUPPLIES Wm. D. THOMAS - SECRETARY HARRISBURG, PENNSYLVANIA
	BUREAU OF ENGINEERING & CONSTRUCTION	SHEET NO. 2
	ARCH. STRUCT. MECH. ELEC.	

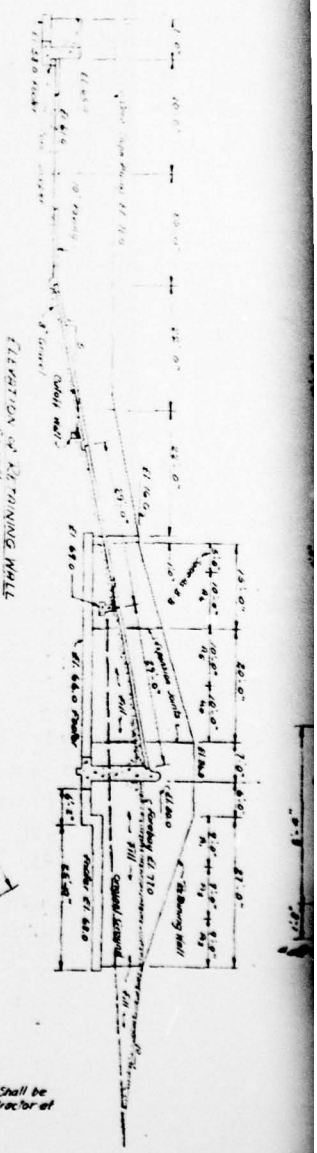
FIGURE 3











Note:-
All Dimensions And Measurements Shall be Checked And Verified by the Contractor at the Site.

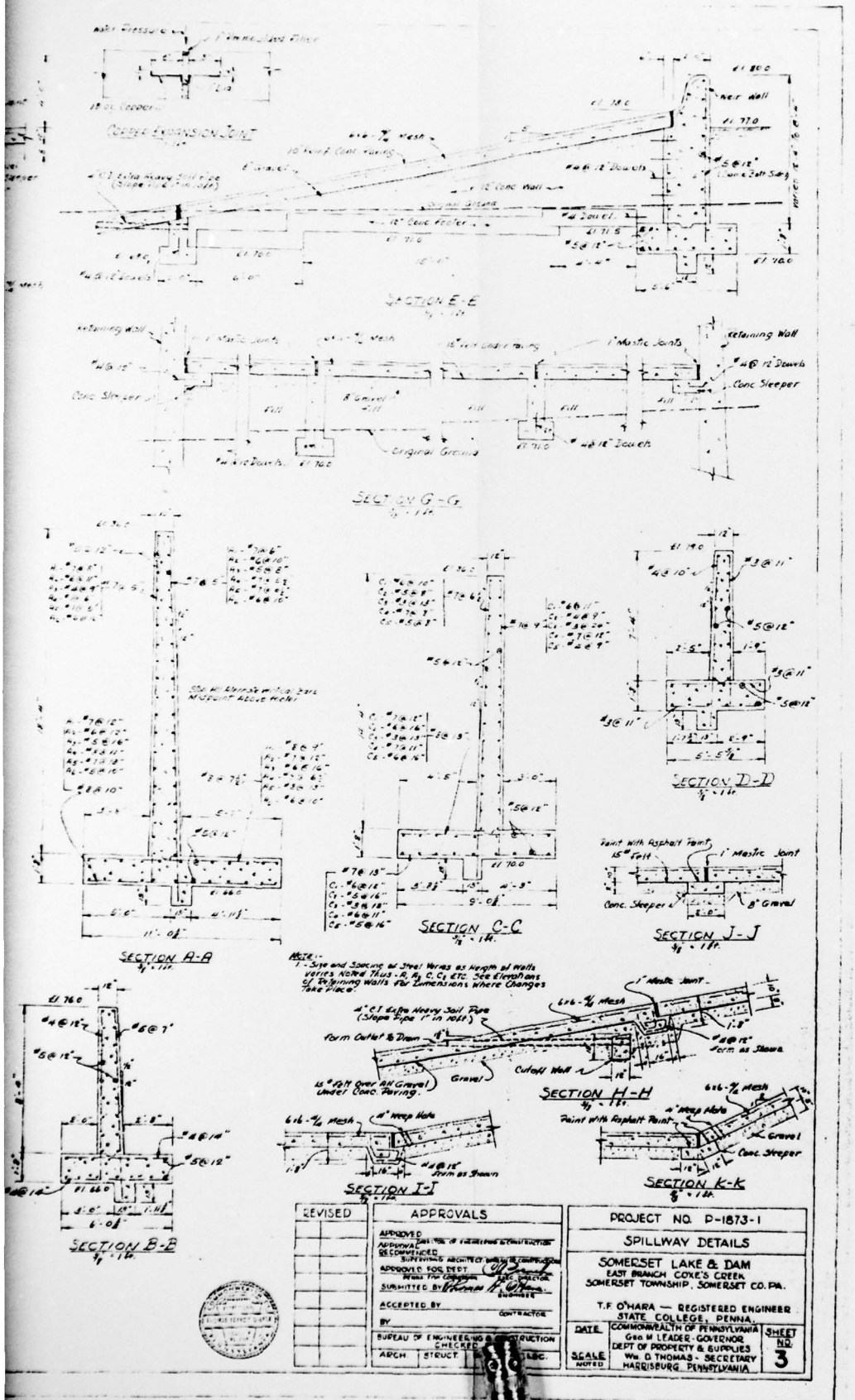
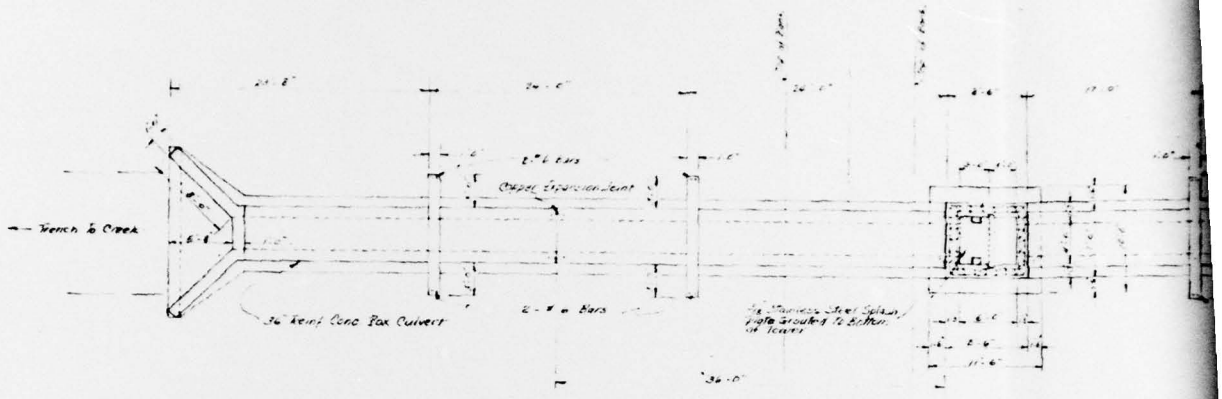
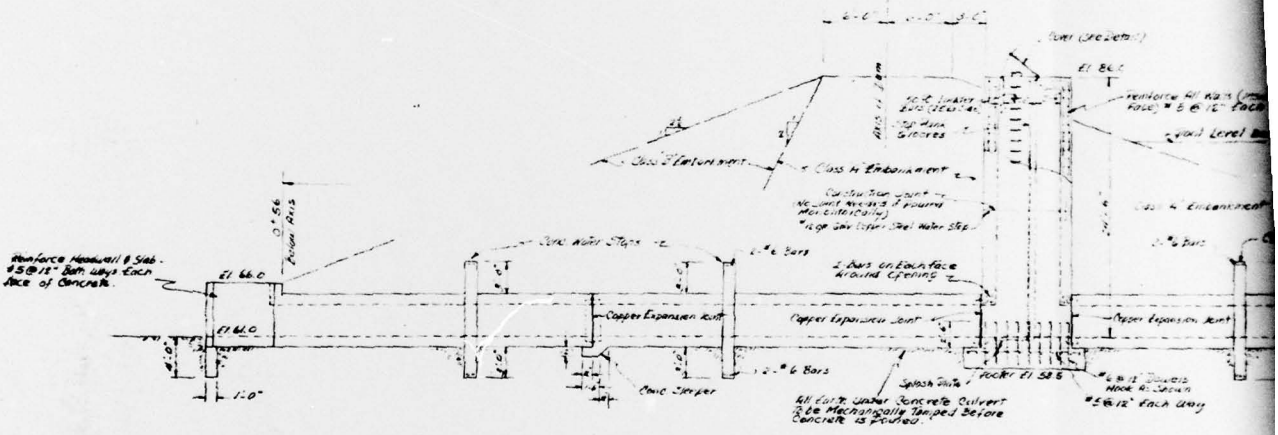

Coxe's Expansion Joint
SECTION E-E
SECTION G-G
SECTION A-A
SECTION B-B
SECTION C-C
SECTION D-D
SECTION J-J
SECTION H-H
SECTION I-I
SECTION K-K
Note:
1 - Size and Spacing of Steel Varies as Height of Walls Varies Noted Thus - R, Ry C, C1 etc. See Sheet Nos. of Retaining Walls for Dimensions where Changes Take Place.
REVISED
APPROVALS
APPROVED
APPROVAL RECOMMENDED
APPROVED FOR DEPT.
SUBMITTED BY
ACCEPTED BY
BY
BUREAU OF ENGINEERING & CONSTRUCTION
CHECKED
ARCH
STRUCT.
ELEC.
PROJECT NO. P-1873-1
SPILLWAY DETAILS
SOMERSET LAKE & DAM
EAST BRANCH COXE'S CREEK
SOMERSET TOWNSHIP, SOMERSET CO. PA.
T.F. O'HARA — REGISTERED ENGINEER
STATE COLLEGE, PENNA.
DATE
SCALE NOTED
COMMONWEALTH OF PENNSYLVANIA
Geo. M. LEADER - GOVERNOR
DEPT. OF PROPERTY & SUPPLIES
Wm. D. THOMAS - SECRETARY
HARRISBURG, PENNSYLVANIA
SHEET NO. 3

FIGURE 4



PLAN of TOWER & CULVERT
3/16" = 1'0"

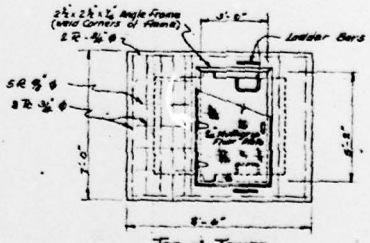


ELEVATION of TOWER & CULVERT
3/16" = 1'0"

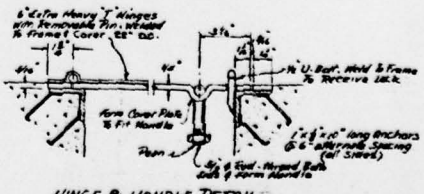
CONCRETE and REINFORCING STEEL SPECIFICATIONS

1. Keyways Shall be Provided at all Construction Joints and Unless Otherwise Noted Shall be a Minimum of 2½" Deep and 10" Section Width.
2. Square Bars and Spacing Noted Thus:- #6@12"
3. Round Bars and Spacing Noted Thus:- #6@12"
4. Steel Wire Fabric Noted Thus:- 6"x6"-4/4
5. Dowel Bars Shall be the Same Size as Corresponding Wall Bars Unless Otherwise Noted.
6. Stress Steel is Always Shown Next to the Surface of the Wall, or Slab, and Shall Have the Following Cover from Center of Stress Bar to Surface:-
   - 3" Where Footers or Slabs are Poured Directly on Ground.
   - 2" Where After Removal of Forms the Concrete Will be Exposed to the Weather or in Contact with the Ground, for Bars more than ¾" Diameter.
   - 1½" Where any Portion of Forms the Concrete Will be Exposed to the Weather or in Contact With the Ground for Bars ¾" or less in Diameter.
7. The Amount of Steel Shown Shall be Doubled Thru Construction Joints only for a Distance Not less than 40 x Diameter of Bar Each Side of the Joint.
8. All Bars Where Spliced Shall be Lapped 40 x Diameter of Bars.
9. Splices Shall Not be Made at Points of Maximum Stress.
10. All Reinforcing Steel Shall be Bent as Noted in Accordance With A.C.I. Building Code Requirement. (A.C.I. 318-47)
11. All Expansion Joints Where Concrete Joins Concrete, Surface Shall be Tooled With Asphalt Joint.

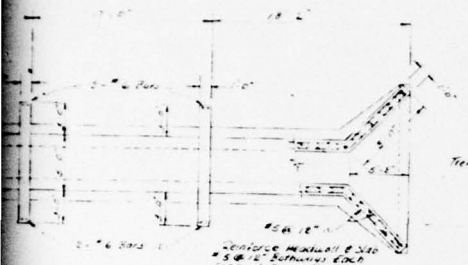
NOTE:-
All Dimensions and Measurements Shall be Checked and Verified by the Contractor at the Site.

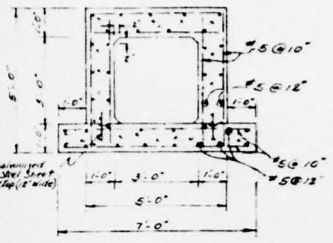


TOP of TOWER
¾" = 1'0"

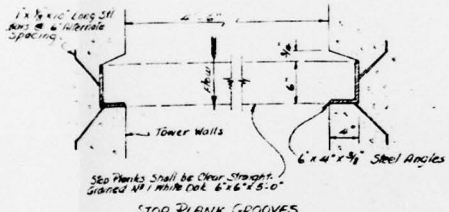


HINGE & HANDLE DETAIL
3" = 1'0"

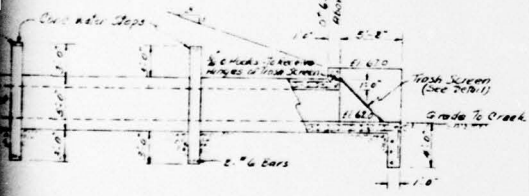


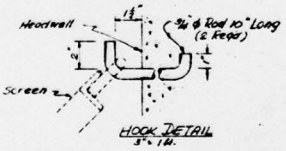


SECTION THRU CULVERT
3/8" = 1'-0"

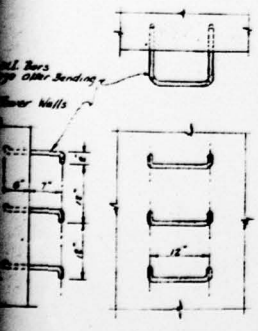


STOP PLANK GROOVES
1/4" = 1'-0"

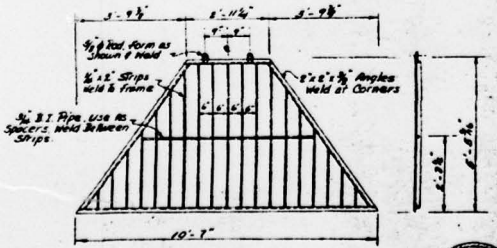




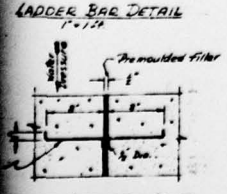
HOOK DETAIL
3" = 1'-0"



LADDER BAR DETAIL
1" = 1'-0"



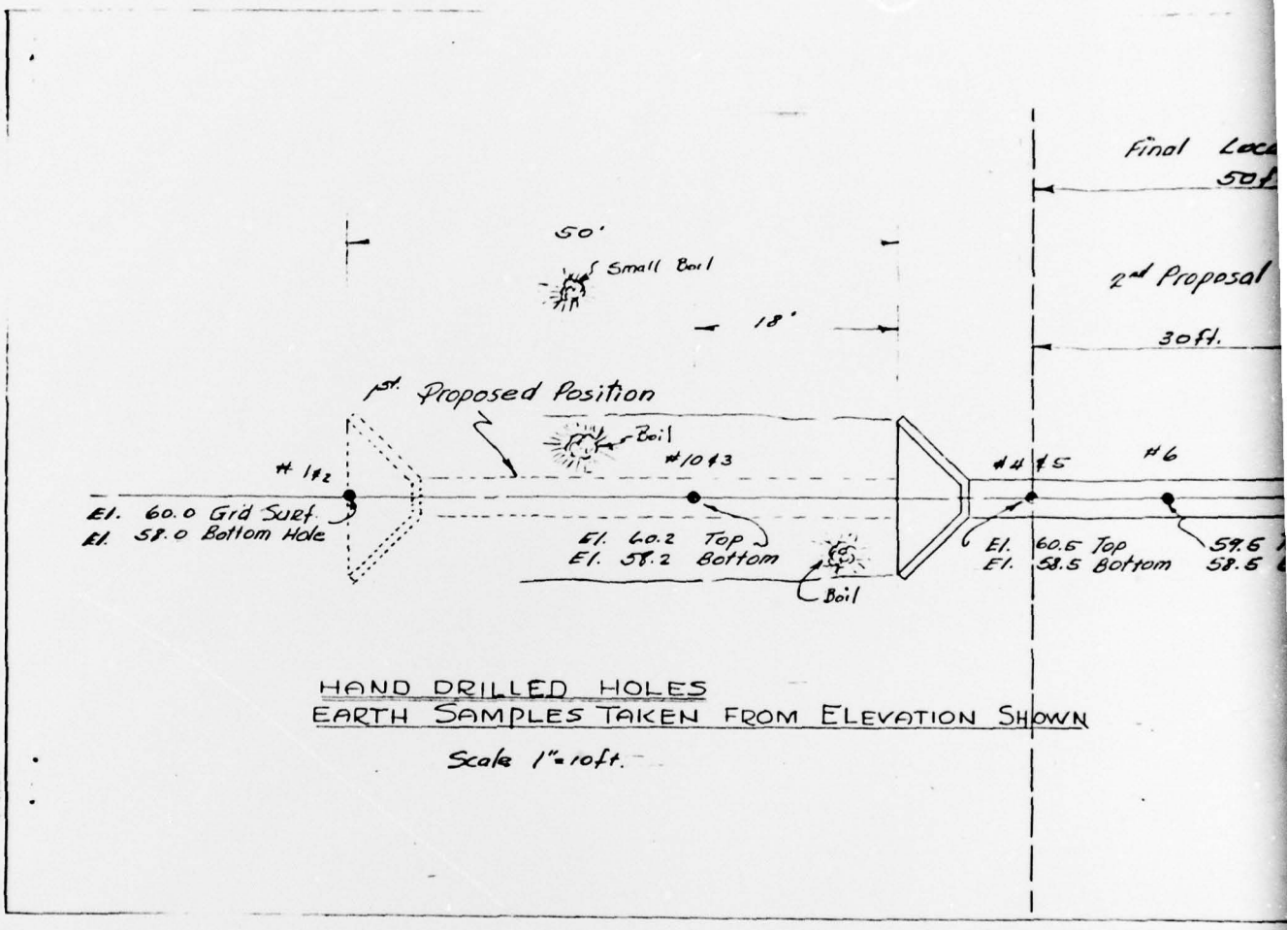
TRASH SCREEN
1/2" = 1'-0"



COPPER EXPENSION JOINT
1" = 1'-0"

REVISED	APPROVALS	PROJECT NO P-1873-1
	APPROVED DIRECTOR OF PURCHASING & CONSTRUCTION	OUTLET TOWER & CULVERT
	APPROVAL RECOMMENDED SUPERVISING ARCHITECT - BUREAU OF CONSTRUCTION	SOMERSET LAKE & DAM EAST BRANCH COAL'S CREEK SOMERSET TOWNSHIP, SOMERSET CO. PA.
	APPROVED FOR DEPT. CHIEF ENGINEER, BUREAU FIRE PROTECTION	T. F. O'HARA — REGISTERED ENGINEER STATE COLLEGE, PENNA.
	SUBMITTED BY ENGINEER	DATE
	ACCEPTED BY CONTRACTOR	SCALE NOTED
	BY	COMMONWEALTH OF PENNSYLVANIA GEO. M. LEADER — GOVERNOR DEPT. OF PROPERTY & SUPPLIES WM. D. THOMAS — SECRETARY HARRISBURG, PENNSYLVANIA
	BUREAU OF ENGINEERING & CONSTRUCTION CHECKED BY	SHEET NO 4
	ARCH. STRUCT MECH. ELEC.	

FIGURE 5



HAND DRILLED HOLES
EARTH SAMPLES TAKEN FROM ELEVATION SHOWN

Scale 1"=10ft.

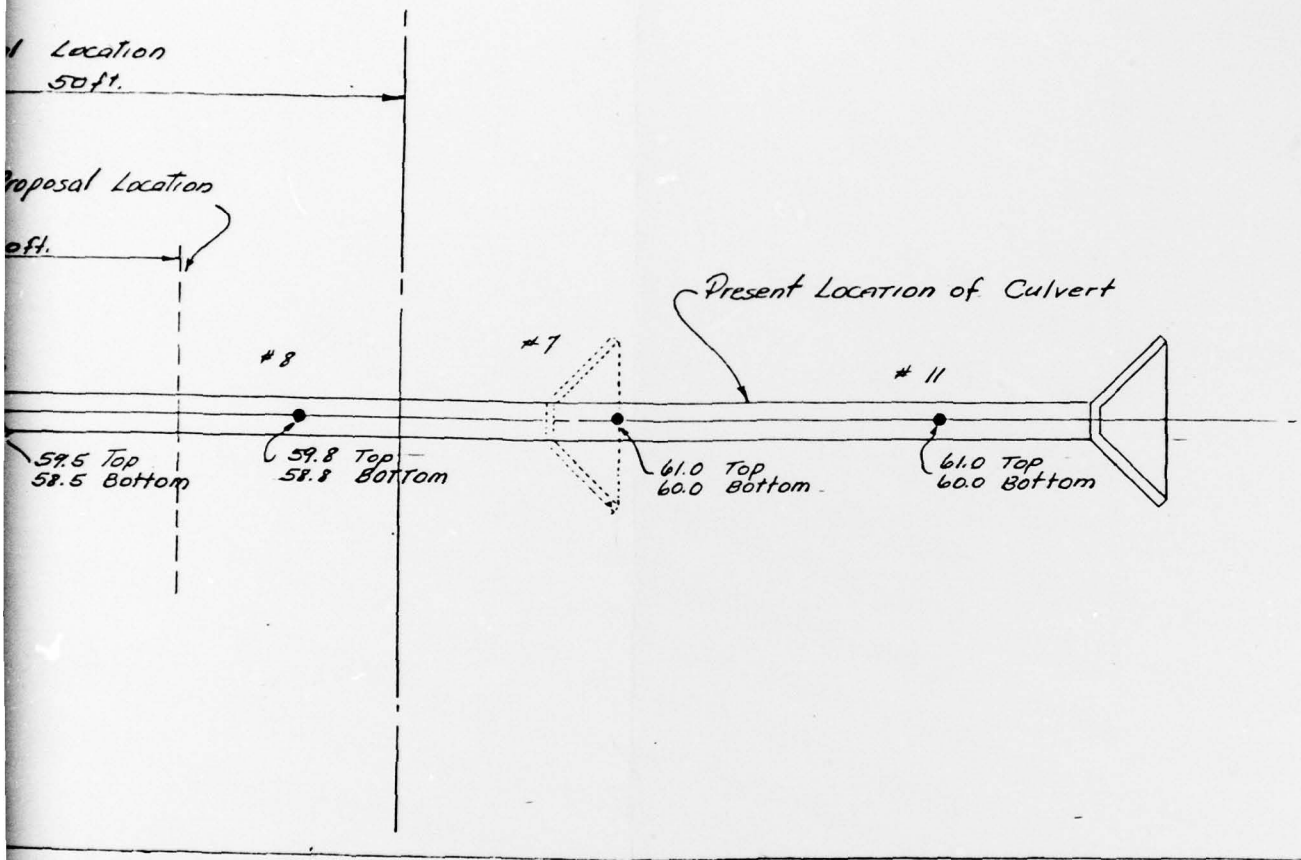
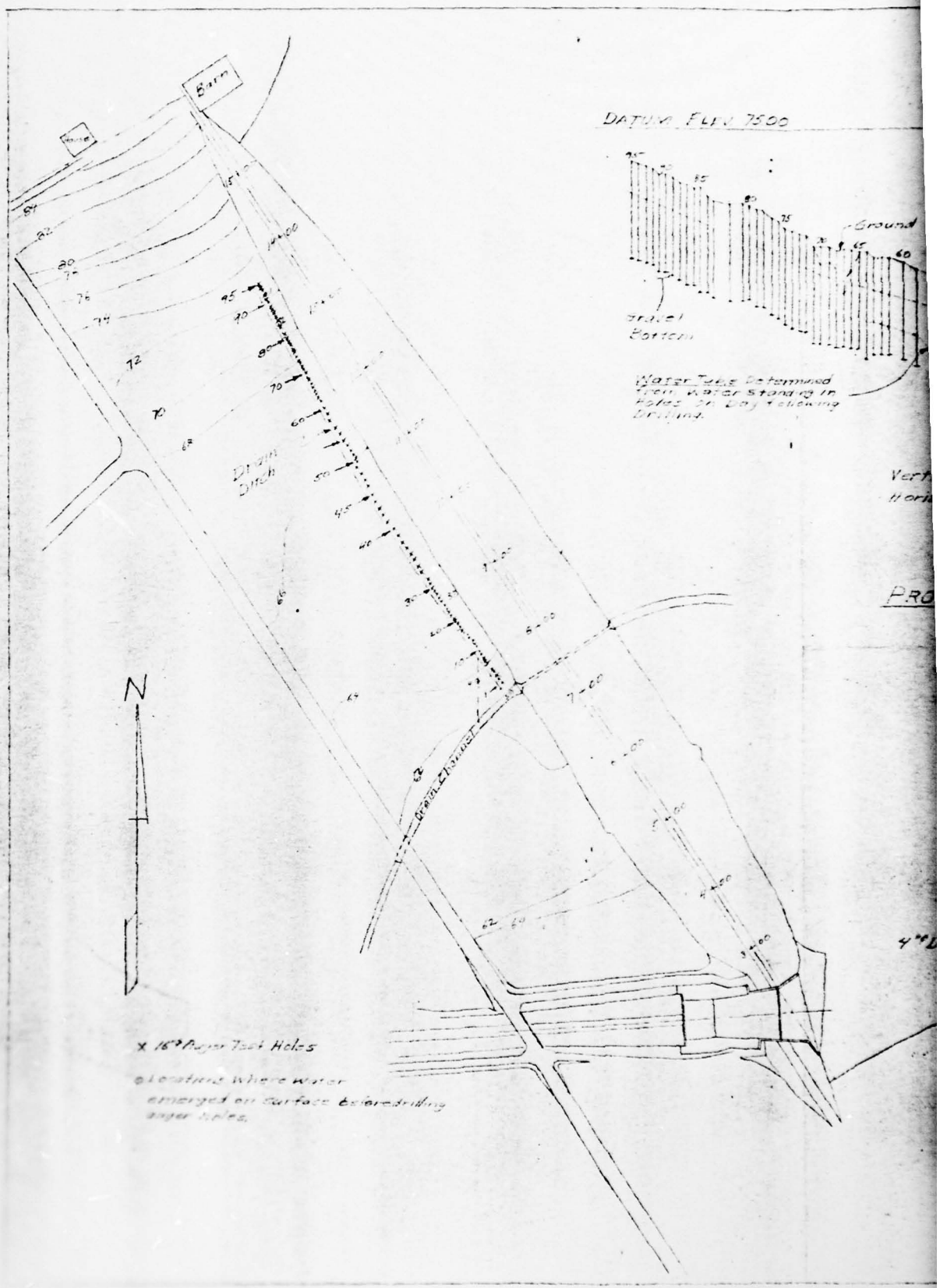
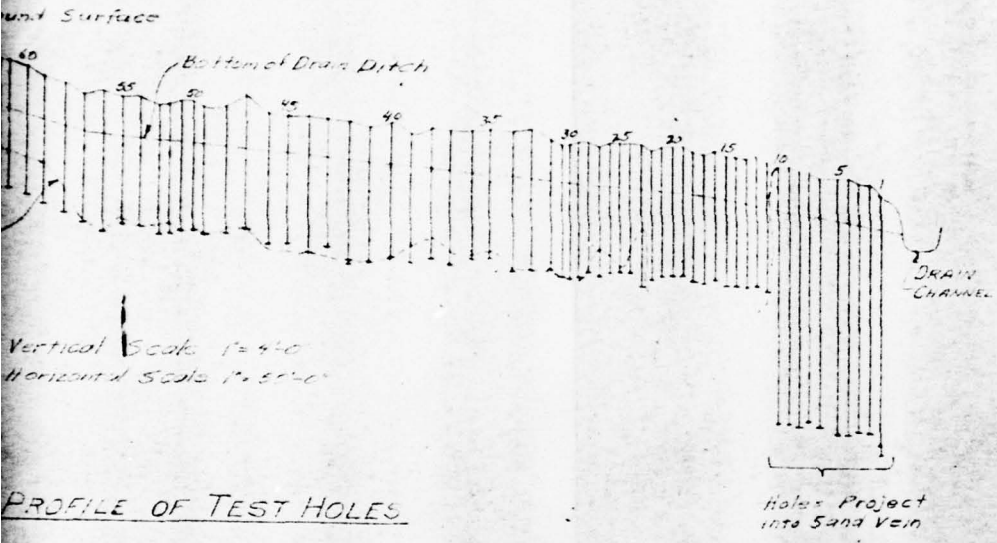
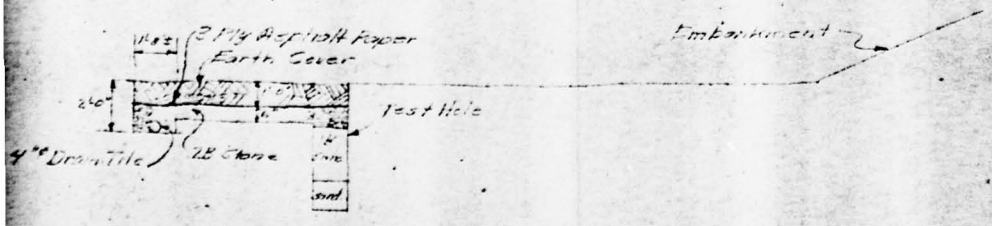

Location
50 ft.
Proposal Location
ft.
Present Location of Culvert
#8
#7
#11
59.5 Top
58.5 Bottom
59.8 Top
58.8 Bottom
61.0 Top
60.0 Bottom
61.0 Top
60.0 Bottom

FIGURE 6


DATUM ELEV. 7500
Barn
House
Ground
Gravel Bottom
Water Table Determined from Water Standing in Holes at Day Following Drilling.
Drain Ditch
Gravel Channel
N
X 16" Auger Test Holes
Location where water emerged on surface below drilling auger holes.



PROFILE OF TEST HOLES



TYPICAL SECTION
Scale 1"=4'-0"

TEST HOLES & DRAINAGE DITCH

SOMERSET DAM

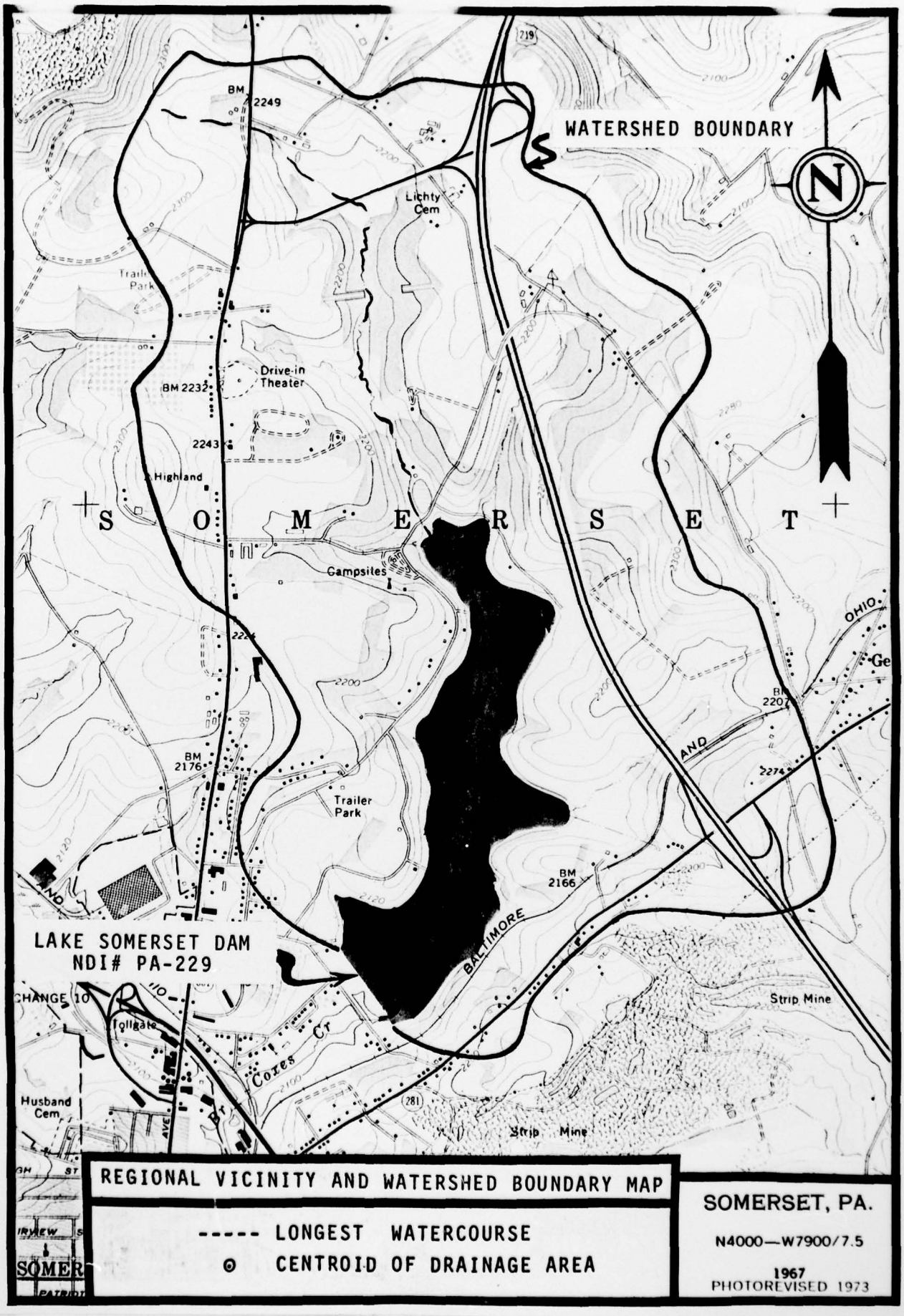
PENNSYLVANIA FISH COMMISSION

Drawn by RJS 5-13-57

FIGURE 7

APPENDIX G

REGIONAL VICINITY AND WATERSHED BOUNDARY MAP


WATERSHED BOUNDARY
N
BM 2249
Lichty Cem
Trailer Park
Drive-in Theater
BM 2232
2243
Highland
S O M E R S E T
Campsites
BM 2176
Trailer Park
BM 2166
BALTIMORE
AND
OHIO
Strip Mine
LAKE SOMERSET DAM
NDI# PA-229
CHANGE 10
Tollgate
Cores Cr
Husband Cem
Strip Mine
REGIONAL VICINITY AND WATERSHED BOUNDARY MAP
----- LONGEST WATERCOURSE
⊙ CENTROID OF DRAINAGE AREA
SOMERSET, PA.
N4000—W7900/7.5
1967
PHOTOREVISED 1973